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The crash of the Revco leveraged buyout: the hypothesis of inadequate capital. (Leveraged Buyouts Special Issue)

Bruner, Robert F.; Eades, Kenneth M.

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ABSTRACT: The bankruptcy of Revco Drug Stores is one of the most notable in the history of highly leveraged transactions. This study considers the allegation that the leveraged buyout of Revco left it without adequate capital to survive. We use Monte Carlo simulation to determine Revco's financial coverage ratios and the expected probability of financial survival. The simulation finds a very low probability that Revco would survive the heavy debt and preferred stock obligations during the first three years following the buyout. The simulation approach provides a useful perspective on the efficacy of the insolvency and capitalization tests as evaluated by the courts. We argue that capital adequacy on the day of going private is extremely difficult to prove using a point-estimate valuation; a simulation-based test provides the more appropriate statistic - i.e., a probabilistic assessment of survival. (Reprinted by permission of the publisher.)

TEXT:

* On July 28, 1988, Revco Drug Stores filed for bankruptcy in what is arguably the most notable failure in the annals of highly leveraged transactions. The firm collapsed merely 19 months after going private, a life span astonishing for its brevity. At closing in December 1986, the leveraged buyout (LBO) was one of the largest ever ($1.4 billion) and, featuring nine discrete layers of securities in the capital structure, was certainly one of the most complex. At bankruptcy, Revco gained distinction as the first "megafailure" among LBOs, a leader in what is by now a long line of prominent collapses, including Campeau (Allied/Federated), Integrated Resources, Ames Department Stores, Circle K. Hillsborough Holdings, and Greyhound. On December 17, 1990, the court-appointed U.S. Bankruptcy Examiner opined that the Revco case revealed "viable causes of action . . . against a broad panoply of defendants under fraudulent conveyance(1) and other legal theories" (Zaretsky [24,p.3]). Notable in the panoply were Revco's financial advisors, and their inclusion was an unprecedented extension of the doctrine of fraudulent conveyance.

Perhaps the most arresting aspect of this case is the allegation made in the financial press,(2) and eventually by the bankruptcy examiner himself,(3) that the leveraged buyout left Revco with an unreasonably small amount of capital. Showing than an LBO rendered a firm inadequately capitalized can be the acid test for applying the principle of fraudulent conveyance in a bankruptcy case.(4) Therefore, the objective of this study is to test the hypothesis of inadequate capital by simulating the financial performance of the company, using financial data on Revco, and comparable companies, that was publicly available on the day Revco went private.

The simulation approach was motivated by Gordon Donaldson's classic application of simulation to corporate debt policy [6]. According to Donaldson, "The answer [about the financial survival of the firm] lies in the behavior of cash flows" [6, p. 164]. Thus, to test the hypothesis of inadequate capital, we tested whether Revco's debt service was too high by estimating means and variances of the major components of cash flow using historical data and forecasts for the industry and for Revco. The resulting

model yielded an entire range of cash-flow scenarios and an implied probability of survival.

If the allegations by the bankruptcy examiner and others are simply ex post rationalizations, we would expect the simulations to produce a reasonably high probability of survival. On the other hand, if the simulations reveal a low probability of survival, the results would be consistent with the hypothesis of inadequate capital. Either way, the simulation approach has the virtues of harnessing the information available to analysts at the date of the buyout and casting that information into a probabilistic assessment of survival.

The study offers two principal findings:

(i) Viewed ex ante, Revco had an extremely low probability of successfully servicing its liabilities over the first three years after it went private.

(ii) When compared with historical performance information for Revco and other similar companies, the forecast assumptions used by Revco's financial advisors were optimistic.

The failure of Revco Drug Stores stands as a provocative counterpoint to much of the previous academic research on LBOs ([2], [3], [4], [11], [12], [13], and [21]).. These studies suggest that the LBO aligns the incentives of managers and shareholders, binds managers to deliver cash to investors, rationalizes internal organization, and reduces costs. Indeed, Revco's proxy statement cited these and other virtues as motives for the LBO,(5) and the examiner's report suggested that some progress was made toward realizing these benefits. In a recent paper, Wruck [23] cited evidence that the investor group overpaid for Revco, but concluded that management's ineptitude was more likely to blame for Revco's failure then how the LBO was structured. With the aid of the simulation results, however, we contend that truly exceptional performance on the part of Revco management would have been necessary to avert the company's demise. Moreover, our conclusions are robust with respect to the assumptions of the parameters of the key variables in the simulation. The same simulation technique applied to Eckerd Drugs, a competitor of Revco that underwent an LBO at about the same time, gives a much higher probability of survival. The respective probabilities of survival for Eckerd and Revco are supportive of the simulation technique, as Eckerd has survived its LBO to date, while Revco has not.

I. The Demise of Revco

The buyout of Revco in 1986 consummated a long episode of anxiety for Sidney Dworkin, Revco's chief executive officer, about possible takeover threats, internal fighting over control of the firm,(6) and declining financial performance.(7) The performance of Revco's common stock over the period 1984-1986 provides a clear picture of how poorly the company performed prior to the 1986 LBO

Exhibit 1 is a graph of monthly market-adjusted returns and cumulative market-adjusted returns(8) (CMAR) for Revco during the period 1984-1986. Shareholders lost significant wealth over 1984-1985, as evidence by the CMAR of -40% at the end of 1985. During 1986, the year of the buyout, shareholders recovered somewhat to an ending CMAR of -23.5%.(9) The effects of several events are identifiable in Exhibit 1. The sharp drop in returns in April 1984 coincides with the government recall of E-Ferol, a vitamin E supplement produced by a Revco subsidiary. Analysts estimated that Revco's liability could mount to $75 million; yet the drop in market value associated with this event was $160 million. Further deterioration in returns later in 1984 is associated with the announcements of worse-than-expected financial performance. The declines in CMAR in February-March 1985 are associated with management changes and the removal of dissident directors. Later in 1985, additional declines are associated wit worsening financial performance and the downgrading of Revco's debt ratings by the major rating agencies.(10)

An independent investment banker first proposed the idea of an LBO to

Sidney Dworkin on September 17, 1985. Revco retained Salomon Brothers, Inc., shortly thereafter to advise on the feasibility of an LBO. Salomon rationalized Revco's poor recent financial results as being the result of "temporary problems" [24, p. 36]. Wells Fargo Bank met with Salomon and Revco management on January 24, 1986, to develop a syndicate of banks to provide senior debt in the transaction, and the bank provided a commitment letter in early March 1986.

On Tuesday, March 11, 1986, Dworkin presented a proposal for an LBO to the Revco directors. The proposal called for shareholders to receive $33.00 per share in cash and $3.00 per share in exchangeable preferred, a 17.6% premium over the previous Friday's closing price on the New York Stock Exchange. The LBO announcement produced a two-day (Monday and Tuesday) market-adjusted return of 8.4%. Dworkin's announcement generated a vigorous debate within the financial community regarding the adequacy of the bid,(11) which eventually led him, on June 2, 1986, to present a revised offer to the board of $38.50 in cash. The directors accepted the offer on August 15th, and Revco stockholders voted to approve the acquisition on December 17, 1986. Revco was taken private on December 29, 1986, at a 48% premium over the firm's stock price 12 months earlier and a 71% premium over the price at which Revco repurchased shares in July 1985.

Through the summer and fall of 1986, Revco's management watched the performance of the firm fall short of budget. Net income for the year that ended May 31, 1986, was down 17.6% from the previous year. During the first quarter of fiscal 1987, June-August 1986, operating income was 21.8% lower than plan. Management attributed the poor results to the entry of new discounters into the discount-drug retailing industry. In October 1986, the operating budget was revised to provide a forecast for use in the prospectus for the LBO's subordinated notes, the proxy statement to shareholders, and the solicitation statement for old the revised holders. As indicated in Exhibit 2, however, even the revised budget was well above Revco's actual performance for fiscal 1987. An internal memo written by Revco's treasurer and dated January 2, 1987 -- four days after the LBO closed -- expressed serious concerns about the firm's worsening cash flows:

> I am very concerned about cash flow since the sales for the past six weeks have been poor resulting in approximately $30 million less cash flow. It will be very difficult to make up this loss of funds. In fact, we have no excess cash going forward. [24, p. 199]

Exhibit 2. Revco Operating Income (in $ Millions) by Quarter for Fiscal Year 1987

	Original Budget	Revised Budget	Actual Results
First quarter (June - Aug. 1986)	$24.5	$19.1	$19.1
Second quarter (Sept. - Nov. 1986)	39.9	24.7	24.6
Third quarter (Dec. 1986 - Feb. 1987)	68.4	66.4	34.7
Fourth quarter (Mar. - May 1987)	56.0	60.8	50.7
Year	$188.9	$171.0	$129.1

Source: Zaretsky [24].

The reports for the four-week and 32-week periods ending January 10, 1987, showed an extremely disappointing Christmas season. What followed was a progressive financial asphyxia that prompted Revco's anxious bankers to meet with company in February and March.

On March 31, 1987, the banks were informed that Dworkin would step down as CEO (although he would remain board chairman), a move that reflected the sentiments of the banks and Salomon that Dworkin "was more entrepreneurial and not experienced or capable of running the operations on a day-to-day basis in a highly leveraged environment" [24, p. 133]. At this

same meeting, the banks were informed that progress on asset sales had been delayed, operating income was running below budget, and inventories were over plan. By May 1987, the end of the fiscal year, the situation was such that Revco's new chief financial officer at the time would later state that he believed the firm "was in serious danger of not being able to make debt service payments due in May" [24, p. 137].

On September 25, 1987, Sidney Dworkin agreed to sever his relationship with Revco in return for repurchase of his stock at the price at which he had invested in the LBO, even though the firm had deteriorated in the preceding nine months. Boake Sells, former CEO of Dayton Hudson, took over Dworkin's position. Because of various cash-flow problems, the firm was unable to obtain inventory necessary to stock the stores for the December 1987 Christmas season. As a result, stock-outs were especially severe, and up to 20% of the appropriate inventory was not available in stores.

On March 10, 1988, Salomon's high-yield-bond sales force stopped making a market for Revco's debt securities. Twelve days later, Salomon deleted Revco from its monthly report, "The Safest of High Yields." At the same time, Boake Sells met with Salomon and expressed his displeasure with the level and quality of Salomon's advisory services.

On April 13th, Salomon presented a restructuring proposal to Revco. Sells rejected it, and after soliciting restructuring proposals from other firms, Revco retained Drexel Burnham Lambert on April 19th to devise a restructuring plan.

On June 16, 1988 Revco missed its first interest payment and omitted a quarterly preferred stock dividend. Drexel appealed to the firm's investors to grant Revco "breathing room." When these appeals were rejected, the firm filed for bankruptcy on July 28, 1988.

II. The Hypothesis of Inadequate Capitalization

To prove fraudulent conveyance in the failure of a leveraged buyout plaintiffs must establish two points. First, they must argue that the firm never received "reasonably equivalent value" from secured lenders in return for giving them a security interest; i.e., that the funds went directly from the lender to the selling shareholders, thus burdening the firm to the detriment of its unsecured creditors. Michel and Shaked [16, p. 43] have argued that this requirement is virtually always met by the structure of the LBO transaction. Second, the plaintiffs must show that, as a result of the LBO, the firm was (i) left insolvent, or (ii) left with "unreasonably small capital."

The test of insolvency considers whether the sum of liabilities at the date of the LBO was greater than the value of the firm's assets. Regarding this test, Wruck [23] concluded: "Assuming the data from Eckerd's LBO provide the best value estimate, it appears the investor group paid somewhere between $200 and $350 million too much for Revco" [23, p. 86]. Kaplan reported a median premium of 42.3% for a sample of 76 management buyouts completed in the period 1980-1986 (see Kaplan [13, Table 2]) and 38.7% for 15 MBOs in 1986 (see Kaplan and Stein [14, Table 1]). For Revco, the premium equalled 48% over the early 1986 price and 71% over the July 198 price. The examiner concluded(12) that "it appears that under most tests Revco would have been solvent, although not in all cases" [24, p. 171]. We argue that the asset valuation required by the solvency test is technically quite difficult and prone to error in the instance of Revco. Instead, we focus on the test of "unreasonably small capital," i.e., whether the LBO rendered the firm incapable of continuing its business and meeting its financial obligations as they became due.

The examiner listed a number of qualitative facts in support of the hypothesis that the Revco deal was economically unattractive. First was insufficient demand by the lenders for the deal: of 33 banks invited to participate in the syndicate, only 11 actually did. Because the initial round of commitments was insufficient to finance the deal, fees to the banks had to be increased to induce them to step up their lending

commitments. Second, the appraised asset value of Revco was less than the purchase amount under certain assumptions. Third, although other bidders were rumored to be preparing offers, in fact none appeared to top Dworkin's bid. Fourth, Moody's and Standard & Poor's, the rating agencies, declared Revco's LBO to have a "negative outlook" more than a month before the deal was consummated. Fifth, internal bank memoranda acknowledged that the firm would survive only with aggressive asset sales. And finally, the performance of the firm had been declining to the point, in the fall of 1986, of necessitating a rebudgeting of fiscal year 1987.

In addition to the qualitative evidence, the examiner's report cited financial analyses prepared by Midland Bank and Alex. Brown & Sons as quantitative support of the inadequate capitalization hypothesis. A "reasonable case" scenario prepared by Marine Midland Bank(13) led the examiner to conclude that Revco would be unable to meet its cash requirements starting in 1989. Further scenario analysis by Alex. Brown & Sons projected financial difficulty in 1988, 1989, and 1990 which prompted the examiner too conclude that "a strong case can be made that Revco was left with unreasonably small capital as a result of the Revco LBO" [24, p. 196].(14)

From a financial economic point of view, however, the formal analyses and other evidence provided by the examiner leave much to be desired. The discounted-cash-flow (DCF) method of valuation was the primary method used by the examiner to test for insolvency. Applying the DCF technique to a highly levered transaction is difficult to do correctly, however, because of an inherent simultaneity problem: the market value of equity is needed to compute the cost of equity, which, in turn, is needed to compute the market value of equity.(15) The examiner's report does not disclose now this simultaneity problem was addressed. Moreover, even if the analysis is done correctly, comparison of values of assets and debt at the date of going private sheds no light on the timing, probability, or severity of default at some date in the future. In other words, if any test of insolvency or inadequate capitalization is to be informative, it must embody the uncertainty surrounding the forecast assumptions in a meaningful manner. The examiner's report strives to incorporate uncertainty through scenario analyses. The various scenarios considered leave the reader with no appreciation for the likelihood of default, however, and it is the prospect of default, not a few expected values, in which the creditors, management, and equity investors should be interested.

The only academic research specific to Revco was conducted by Wruck [23]. Although citing evidence that the Revco LBO was overpriced, Wruck also argued that the financial obligations could have been met were it not for the poor performance of Salomon in executing the disposition of certain assets. To illustrate her point, Wruck reported that, based on management's forecasts, only six percent of the assets needed to be sold to service the scheduled interest and principal payments for the first year of the LBO (see Wruck [23, Table 2]). We take exception to Wruck's **calculations** , however, because she omits $87.5 million of principal payment due on the term loan in the first calendar year.(16) With the inclusion of this payment, Wruck would have concluded that 44% (60% on the basis of actual results) of the total asset sales were necessary for Revco to survive the first year. More fundamentally, however, we take Donaldson's [6] position that point estimates for a single year cannot be used to assess survival probabilities accurately over a period of years. Only by considering all the moments of the components of cash flow and the cumulative effects of successive years of obligations can we hope to interpret accurately coverage ratios such as those reported by Wruck [23]. In addition, both Wruck and the examiner leave important questions unanswered about the timing, probability, and severity of a default. The answers to these questions offer better insight into the adequacy and reasonableness of the buyout. Thus, we address the examiner's allegation of inadequate capitalization as a testable hypothesis using simulation analysis.

III. A Simulation Approach to Estimating Revco's Probability of Default

Following Donaldson's [5] illustration of Monte Carlo simulation as applied to the evaluation of cash-flow adequacy, we use Monte Carlo simulation to test the ability of Revco to cover its annual cash obligations; in particular, we use the technique to yield an estimate of the probability of successfully covering the firm's cash interest, debt principal, and preferred dividend payments over the first three calendar years following the buyout. At issue is the sensitivity of the probability of survival based on variations in the operating assumptions used by Revco and Salomon versus assumptions consistent with the historical performance of comparable companies and Revco.

A. The Variables

The simulation model forecasts a cash-flow debt-service coverage ratio ("CF Coverage") for 1987, 1988, and 1989, the first three years following the LBO. Revco used a fiscal year end of May, 31, but, because the LBO was consummated on December 29, 1986, we adopted the convention of using the calendar year as the first year to coincide with the LBO date. Thus, each of the projected years contains 12 months of sales covering the calendar years 1987, 1988, and 1989. The structure of the financing makes a longer forecast period unnecessary, because the first three years following the buyout represent the maximum risk exposure for Revco.(17)

Cash-flow coverage ratio was **calculated** as EBIT (earnings before interest and taxes) plus proceeds from asset sales (AS) less capital expenditures on new stores (CAPEX) plus depreciation (DEPR),(18) divided by cash interest payments (INT) plus principal payments (PRIN) plus cash dividends (DIV), i.e., (1) CF Coverage = (EBIT + AS - CAPEX + DEPR/(INT + [PRIN + DIV) The ratios were modeled in a Lotus 1-2-3 spreadsheet and simulated with 200 iterations using "@RISK" simulation software.

For the most part, Revco's financial obligations (INT, PRIN, and DIV) were known at the time of the buyout and were, therefore, entered in the model as fixed numbers. Exhibit 3 summarizes Revco's cash payment obligations for the simulation period, 1987-1989. Interest on fixed-coupon debt, principal, and preferred dividend payments was determined according to the schedules reported in Securities and Exchange Commission (SEC) filings [1], [20]. Only cash payments were included in the simulation; no consideration was given to noncash obligations such as payment-in-kind (PIK) preferred stocks. Of the three preferred issues used in the buyout, two, the 15.25% cumulative exchangeable and the 17.62% cumulative junior preferred, were PIKs. The 12.0% cumulative convertible preferred stock with a face value of $85 million is responsible for the $10.2 million of preferred dividends reported in Exhibit 3.(19)

Reported separately in Exhibit 3 are fixed- and floating-rate interest payments. Of the $1,331 million of debt used in the LBO, $455 million had a floating interest rate, and the remaining $876 million had fixed rates. The fixed-rate debt obligations had an average interest rate of 12.9% with no principal payments due during the study period. The term loan was structured in such a way that Revco could choose interest payments as either 1.75% over the prime rate or 2.75% over LIBOR (London Interbank Offer Rate). The floating interest payments reported in Exhibit 3 assume that the prime-rate option is chosen and that prime remains at the December 1986 rate (7.50%) for the entire three years. The only payments of principal during the study period are for the term loan, as specified by its amortization schedule. Thus, the floating interest payments decline over time as the term loan is retired, whereas the fixed interest payment remains constant at $112 million. To simulate the floating-rate interest payments, we modeled all the prime rate (PRIME) as a normal distribution with mean equal to the December 1986 rate of 7.50% and a standard deviation of 3.60%, as estimated from historical data.

Exhibit 3. Revco's Financial Obligations for 1987-1989
(in Thousands)

	1987	1988	1989
Principal payments	$132,500	$152,500	$ 70,000
Fixed interest payments	112,802	112,802	112,802
Floating interest payments	42,088	29,831	15,725
Preferred dividends	10,200	10,200	10,200
Total cash obligation	$297,590	$305,336	$208,727

Sources: [1], [20].

EBIT, AS, and DEPR remain as the stochastic variables needed to compute the coverage ratios. To **calculate** EBIT, we multiplied sales by an EBIT margin defined as (2) MARGIN = EBIT/SALES. MARGIN was modeled as normal with mean and variance estimated from historical performance data for Revco and other comparable companies.

The sale of existing stores and other assets (AS) was modeled as the appraisal figure given in the prospectus ($230 million). Consistent with the prospectus, we assumed that the company could realize 100% of the divestiture proceeds during the first two years of the LBO. AS for 1987 was assumed to be uniformly distributed over 25 to 75%; i.e., the model assumed that Revco could sell with equal probability anywhere from $57.5 million to $172.5 million of the $230 million of assets in the first year. For 1988, the second year after the buyout, AS equals the $230 million less the realization of 1987 asset sales. Because of holding the total asset sales constant at $230 million, the only uncertainty introduced into the model is the timing of the asset sales.

We modeled AS as described for several reasons. Unlike most other variables in the analysis, no historical data exist to guide us in the modeling of AS. The lack of data makes our modeling choices for AS somewhat arbitrary and, hence, easy prey to criticism. Faced with such a challenge, we chose to model AS in a way that the model would be biased in favor of finding a high survival probability. The first step in this direction was to assume, as Revco did at the time, that Salomon Brothers would be able to sell the assets with the first two year following the LBO. In our view, this assumption represents a best-case scenario for Revco.

The second step was to recognize that allowing the total amount of asset sales to vary around $230 million would, in fact, act to reduce Revco's computed probability of survival. As was true for most LBOs, the Revco financial structure contained a covenant in the term loan that required any excess proceeds of the divestiture to be used as prepayments(20) of the loan. Thus, if Revco should happen to be lucky enough to realize more than the $230 million for the assets at the end of the second year, the extra cash could not be used to service and third year's cash flow obligations. Rather, the money would have to be used as a prepayment of the term loan, which would only slightly reduce the interest payments in the third year. On the other hand, if Revco should realize a shortfall in the sale of the assets, the reduced inflow would significantly reduce the firm's ability to service its obligations in the first and/or second years. The overall effect of allowing the $230 million figure to vary is that the downside fluctuations hurt the survival of the LBO more than the upside fluctuations help it. Thus, our assumptions about AS are conservative and bias the model toward the conclusion that the LBO would succeed. Moreover, the examiner's report reveals [24, p. 151] that Revco's actual sales were approximately 14% under expectations, making our assumptions (expost) somewhat optimistic.(21)

An offset to AS is CAPEX, the outlay required for starting new stores each year. To model this variable, we assumed new stores would open at a rate of 100 per year, consistent with the goals stated in the prospectus. We assumed that $100,000 per store would cover the investment in fixtures, systems, an other assets unrelated to inventory and that, consistent with Revco's past practice, new store buildings and land would be leased.(22) As new stores are added and existing stores sold in the model, total revenue is adjusted according to the assumed sales-per-year figure. Consistent with historical performance, new and mature stores' annual sales for 1987 were

assumed to be $945,000 and $1,015,000, respectively. These sales figures are increased each year by a growth rate (GROWTH), assumed to be inflation, which was modeled as a normal distribution with a mean of 5.0% and standard deviation of 3.90% as measured from a time series of historical inflation rates. Depreciation expense (DEPR) was approximated as $33.7 million for 1987 and was scaled according to the percentage net change of (AS - CAPEX).(23)

B. Parameters of the Distributions

The parameters of MARGIN were estimated using historical EBIT data for Revco and a six-firm peer group from the drugstore retailing industry. Complete EBIT data were available for the sample of drugstore firms for the period 1974-1986. To maintain consistency in the estimation process, we used the same estimation period to estimate the means and variances of GROWTH and PRIME.

Exhibit 4 summarizes the results of our estimation procedure for the parameters of MARGIN, GROWTH, and PRIME. The sample distribution of each variable was tested against the null hypothesis of being normal using the Kolmogorov-Smirnov (KS) goodness-of-fit test. None of the KS tests produced Z-scores significantly different from zero at conventional probability levels. The KS test results suggest that our assumptions of normality are reasonable. The results do not tell us, however, whether the historical MARGIN mean of 6.60% is a reasonable estimate of Revco's future performance at the time of the buyout in 1986. In truth, the final choice of a mean is a subjective process that can always be debated. As a beginning point, however, we review the estimates made by the major players in the deal.

The examiner's report reveals strongly contrasting views among insiders and outsiders about Revco's future performance. Salomon and Revco advocated operating assumptions that others deemed aggressive in light of the performance of comparable companies and Revco's own operating history. The examiner noted that the lowest sales growth are contemplated by Salomon was 8%, while the lowest EBIT margin used was 6.5% [24, p. 34]. The agent bank in the buyout, Wells Fargo, ran a worst-case scenario [24, p. 42] assuming 8% sales growth (5% growth of new stores plus 3% inflation), whereas the investor group provided its banks with forecasts assuming 12% total sales growth. Goldman Sachs, the advisor to Revco's outside directors, determined that a 12% growth-rate assumption was "too aggressive" (a more reasonable assumption was 8%) and that the assumption of a 7.7% gross margin was "a bit aggressive" [24, pp. 52, 53]. Ironically, Goldman ultimately opined that the investor group's projections were "realistically attainable" [24, p. 54].

Part of Revco's sales growth rate depended on the rate at which it planned to open new stores. The company's plan to open 100 new stores per year for the first five years was intended to discourage new entry by competitors into Revco's market areas [20, p. 11]. The wisdom of the aggressive expansion strategy is questionable, however, in light of the resulting drag on operating performance. The examiner noted that 70% of Revco's stores that were open less than one year lost money; the figure dropped to 48% for stores opened between one and two years [24, p. 42].

Our base-case assumptions for the Monte Carlo simulations are compared with the assumptions used by Revco and Salomon Brothers in Exhibit 5. The numbers differ in a couple of critical areas. In particular, our EBIT margin of 6.60% is much more conservative than Salomon's 8.0%. Exhibit 6 displays the time series of EBIT margin (MARGIN) for Revco and the six-firm peer group.(24) The exhibit shows that Revco's average margin for the period was 28% higher than the peer group (6.60% versus 5.15%), but Revco's performance in 1985 and 1986 (margins of 3.50 and 4.84%) was clearly below the long-run average. Revco's peak performance occurred in 1984 when MARGIN reached 8.14%, the only year in which EBIT reached the 8.0% level assumed by Salomon Brothers.

Exhibit 5. Monte Carlo Versus Revco/Salomon Valuation Assumptions

	Monte Carlo Base-Case Assumptions	Revco/Salomon Assumptions(*)
MARGIN, mature stores	6.60%	8.0%
Standard deviation	1.32%	NA
MARGIN, new stores	6.60%	NA
Standard deviation	1.32%	NA
Corporate less growth	NA	12%
Growth rate of sales per store	5.00%	NA
Standard deviation of store Sales growth rate	3.90%	NA
Number of new stores opened per year (CAPEX)	100	100
Floating interest rate Prim + 1.75%	9.25%	10.25%
Standard deviation of prime	3.60%	NA

(*)Source: Zaretsky [24].

These numbers reveal that a 6.60% mean implies a 40% improvement over Revco's performance for the most recent two years (averaged MARGIN of 4.17%) and that Salomon's 8.0% MARGIN represents a 92% increase over the 1984-1985 average MARGIN. These increases in efficiency are much larger than those reported by Kaplan [13] and Muscarella and Vetsuypens [17], who found that margins increase by a total of approximately 19% over the three years following a buyout.(25) All things considered, we judge a 40% improvement in efficiency, as represented by the 6.60% margin, to be a generous expectation in the case of Revco's management.(26)

For the standard deviation of MARGIN, we used 1.32%, the historical standard deviation of Revco's MARGIN for the 13-year time series. The average variance for the six peer companies over the same 13 years equated to a 1.25% standard deviation. Thus, while Revco's mean MARGIN was higher than the peer group, its standard deviation of MARGIN was approximately the same, which supports our choice of Revco's historical volatility for the base case.

For sales growth, we assumed sales per store would grow at an inflation rate of 5% and that new stores would be opened at the rate of 100 per year, less any stores sold. The combination of the 5% inflation growth plus the net growth of new stores is equivalent to an annual corporate sales growth rate of about 9% over the three years, noticeably smaller than Salomon's assumption of 12% growth. Our growth figure appears justifiable, because store growth is modeled as projected by the company, and our perusal of Revco's sales growth revealed no evidence that sales per store should grow faster than inflation in the late 1980s.

Inflation was modeled as a normal distribution with mean 5.0% and standard deviation of 3.90%. Given the low interest rates at the time (Treasury bills had consistently averaged under 6% since June 1986), an expectation of 5% inflation seems generous. Although our overall growth assumption is more conservative than Salomon's, the relevant issue is the influence of the assumption on the results, which our sensitivity analysis revealed to be negligible.

The prime rate was modeled to capture the effect of the floating-interest provision of the term loan. Prime was 7.50% in December 1986, implying a term-loan rate at the time of 9.25%, prime plus 175 basis points. Revco was allowed to reset the interest rate as often as monthly or as infrequently as semiannually. For convenience, and to maintain consistency with the annual data used to estimate the parameters, we assumed the prime rate to be normally distributed and reset at the beginning of each year. As reported in Exhibit 4, the standard deviation of the prime rate had been 3.60% for the period 1974-1986. Thus, PRIME was modeled as normal with mean equal to 7.50% and standard deviation of 3.60%.(27)

No model can be an exact representation of reality. Regarding this

model, we offer a couple of caveats. First, our simulation analysis ignores the effect of taxes, capital improvements to the mature stores, accounts receivable and inventory growth, and interest on seasonal debt. The inclusion of any of these factors, however, would have served only to depress the cash flow coverage ratios and decrease the estimated probability of survival relative to the nominal performance as reported here. Second, our base model assumes no covariance between growth and margins, and it assumes that each year is an independent draw, i.e., there is no serial covariance in MARGIN, GROWTH, or PRIME from year to year. Although not reported here, we found no qualitative difference in our results when we assumed each variable to be a random-walk process with the previous year's outcome being the mean of the current year's distribution. A potentially more important serial covariance problem, however, is that induced by the action of management. For example, if cash flows in 1987 were running behind schedule, management could push to accelerate the asset divestitures to offset the expected shortfall. To the extent that management responds in this manner, the probability of survival as computed by our model has been biased downward. Thus, we have biased the survival probability upward with our **calculation** of cash flow and downward with the assumption of independence of cash flows. Although the net effect of these two biases is not apparent, the covariance bias can be neutralized fairly easily.

Rather than attempt the unwieldy task of modeling all the possible interactive effects, we computed a second probability of survival that allows for complete interaction between the cash flows occurring during the first three years. The "three-year" probability was computed by assuming that the sum of the cash flows for 1987-1989 would be available to service the sum of the financial obligations for the period. In other words, a bad draw in one year would not necessarily lead to ruin if the other two draws were large enough to make up the deficit. This is equivalent to assuming that management can carry forward any excess cash flows as well as borrow costlessly from future excess cash flows. Hence, whereas the net bias of the independent survival probabilities is not apparent, the three-year probability is obviously biased upward and represents an upper bound on Revco's probability of survival.

IV. Results

To illustrate the inputs and outputs of the model, Exhibit 7 presents a series of histograms of variable distributions as modeled for 1987, the first year following the LBO. The histogram in Panel A is a depiction of the EBIT distribution, which is a product of MARGIN and total revenue. Total revenue equals the number of mature stores times sales per mature store plus the number of new stores times the new-store sales rate. The vertical dashed line represents the mean, which is reported at the top of the y-axis as $149.2 million. The histogram's bell shape reflects the dominating influence of modeling MARGIN as a normal distribution. Panel B contains the asset sales (AS) distribution for 1987. The approximately equal bars reflect the assumption that AS is uniformly distributed over the interval {$57.5, $172.5} million with a mean of $115 million. EBIT plus net depreciation and AS equals "cash flow available," which is depicted in Panel C. Cash flow available is the numerator of Equation (1); i.e., the cash available for new-store investments and servicing financial obligations. Because Revco's total financial servicing obligation for 1987 was $297.6 million (see Exhibit 3) and the mean cash flow available is $288.7 million, the implied average CF coverage ratio for 1987 is 0.97, exactly equal to that reported in Exhibit 8 for the 1987 base case.

Exhibit 9 displays the CF coverage ratio distributions for 1987, 1988, and 1989. For these base-case scenarios the mean coverage ratios are 0.97 in 1987, 0.98 in 1988, and 0.96 in 1989. The mass of the distribution to the right of 1.0 represents the probability of surviving a given year. Thus, the cumulative probability of survival is computed as the product of each of the three annual probabilities of realizing a ratio greater than

1.0. For the base case, the three annual probabilities of survival are 0.43, 0.45, and 0.27, and the cumulative probability of survival is 0.052 (0.43*0.45*0.27).

Exhibit 10 is the distribution of the three-year **cash - flow** -coverage **ration** -- i.e., the probability that the sum of the cash flows for 1987-1989 is sufficient to cover the sum of the obligations for the period. This ratio assumes that past and future cash flows are available to service the financial obligations for any year. Thus, the ratio represents a best-case measure of the model's estimate of Revco's ability to pay. The area to the right of 1.0 is the probability of survival. Because the ratio has a mean less than 1.0(0.97) and the variance of the distribution is small, the probability of survival is approximately 30%, much larger than the product of the three independent-year probabilities computed using the Exhibit 5 distributions equal to 5.2%.

To test the robustness of the model to our assumptions, we performed two comparisons. First, we conducted a sensitivity analysis on the means of the stochastic variables.(28) As revealed in Exhibit 10, the coverage ratios for Revco are consistently less than 1.0, and the probability of successful coverage remains low regardless of variations in assumptions for MARGIN, GROWTH, and STORES (the number of new-store openings per year). Increasing the expected EBIT margin to Salomon's assumption of 8.0% results in a probability of survival of 48%, the highest cumulative probability produced in the sensitivity analysis.

The three-year ratio probabilities in Exhibit 8 are consistently higher than the cumulative independent probabilities for the three years. For example, the base-case probability is 30% for the three-year ratio compared to only 5% assuming independent cash flows. The reader should keep in mind that the three-year ratio is a strong upwardly biased measure of survival and that the base-case probability of 30% is, in itself, a very low survival probability. The three-year probability rises to 94% if Salomon's MARGIN of 8.0% is used, but for every other scenario reported in Exhibit 8, the three-year probability is 40% or less. Interestingly, when MARGIN is assumed to equal Revco's average performance for 1984-1985 of 4.17%, the probability of survival is virtually zero under either probability measure. Thus, with the exception of assuming MARGIN to equal 8.0%, the model yields consistently low survival probabilities for Revco.

As a second check of the model's robustness, we applied the simulation to the Jack Eckerd Corporation, one of Revco's competitors in discount-drugstore retailing and itself the subject of a leveraged buyout in 1986.(29). As with Revco, we used historical performance data as the basis for EBIT projections and SEC filings [7] for financial obligation projections. Over the period 1974-1986, Eckerd's MARGIN averaged 8.11% with a standard deviation of 1.42% compared to Revco's 6.60% and 1.32%. A more important difference from Revco, however, was that Eckerd's interest and principal payment schedules were substantially deferred. The simulations for Eckerd produced coverage ratios of 1.30, 1.35, and 1.40 for the first three years following the buyout. These individual probabilities imply a cumulative probability of survival of 95% and a three-year probability of 95% also.(30)

V. Conclusion and Implications

The analysis in this study suggests that Revco had a probability of between 5 and 30% of successfully servicing its financial obligations in the first thee years after going private. These survival possibilities are so low as to suggest that Revco was undercapitalized in the sense that the new debt obligation exceeded its expected cash flow and hence, the buyout was doomed to fail from the start. It is only when Revco's earning power is assumed at almost double that of its recent past that the survival probability (assuming independence of cash flows) approaches 50%. The survival probabilities are relatively insensitive to assumptions concerning asset sales and growth of sales suggesting that it was the leveraged buyout and the restructuring strategy rather than flawed execution of the strategy

by management that drove Revco down. Ironically, the strategy of the newly private Revco was to focus on asset sales and growth, and only secondarily to focus on profitability. The deteriorating environment for retailers in late 1987 and 1988 could be chalked up as bad luck, but we believe the hallmark of a good strategy is the ability to withstand unforeseen adversities. We leave it for others to speculate as to why the deal was consummated.

A simulation-based research methodology, such as that used here, has its weaknesses. Our strategy has been to address the weaknesses by stating them plainly and then to construct the model so that it is based in favor of survival. The base-case assumptions were reasonable in that they were consistent with information a financial analyst would have had in December 1986, when Revco went private. Other assumptions for which there was no strong base of public information or historical experience (e.g., tax exposure, asset sales, working capital requirements) were tilted in Revco's favor. Despite the model being biased in favor of survival, however, we consistently found low survival probabilities and conclude that they arise because of Revco's onerous payment schedule and anemic earning power rather than as an artifact of our methodology. Our sensitivity analysis revealed that even granting the optimistic assumptions used by Revco's financial advisers and bankers produces survival probabilities of less than 50%. Indeed, no set of forecast assumptions surveyed in the bankruptcy examiner's report gave high probabilities of survival. In addition, testing our methodology on another drug retailer taken private at about the same time, Jack Eckerd Corporation, produced high probabilities of survival. In other words, our ex ante approach produced results that are consistent to date with the fates of Revco and Eckerd. Thus, we conclude that the model discriminates reasonably well and is not prone to predict disaster for every LBO.

The primary implication of this study for research on LBOs is that terms of financing matter and warrant scholarly attention. Finance researchers have to date given more attention to the operating aspects in LBOs than to the terms of financing. By "terms of financing," we mean the detailed financial design of the buyout, including the time series of debt service obligations and the underlying terms of the different layers of capital. There is virtually no scholarly work in print on the rich variation in financial design from one buyout to the next. Why, for instance, were the time series of debt service obligations so different for Revco and Jack Eckerd which are fairly similar companies?

The primary implication of this study for jurists, legislators, and practitioners in finance is that "capital adequacy" has less to do with the amount and mix of types of capital and more to do with the firm's expected cash flow and the time profile of debt service obligations. This is consistent with Donaldson's [6, p. 150] conclusion that,

> ... widely used rules of thumb which evaluate debt capacity in terms of some percentage of balance sheet values or in terms of income statement ratios can be seriously misleading and even dangerous to corporate solvency ... debt policy in general and debt capacity in particular cannot be prescribed for the individual company by outsiders or by generalized standards; rather they can and should be determined by management in terms of individual corporate circumstances and objectives and on the basis of the observed behavior of patterns of cash flows.

The public policy debates over leveraged buyouts have been sprinkled with reference to the high debt-equity ratios typical of these deals; but such statistics are weak indicators of risk. An economic test of buyout risk or fraudulent conveyance should look to the probability of survival, though we admit that a precise measurement of this probability is difficult. Moreover, there are no standards by which an objective observer

can parse out expected survivors from expected mortalities. In cases of very low probability of survival like Revco, however, the test of capital adequacy is intuitively easy: only upon extremely optimistic expectations could one have predicted that Revco's financial obligations would be manageable.

In sum, the provocative findings of this study invite more scholarly and applied research on the capitalization of firms. Based on our experience in conducting this study, we conclude that the richest insights in this area are bound to come from the analysis of individual cases of small samples of firms. (1)In the law (i.e., the Bankruptcy Code, the Uniform Fraudulent Conveyance Act (UFCA) and its successor, the Uniform Fraudulent Transfer Act (UFTA)), a fraudulent conveyance is a transfer of property the object of which is to defraud or delay an unsecured creditor or alienate the property from his reach. Where courts find fraudulent conveyance, the liens and security interests of the secured lenders may be set aside and collateral subordinated to the unsecured lender. In the Revco case, the examiner considered the financial advisors, accountants, bank lenders, and even shareholders as possible targets of attack under the theory of fraudulent conveyance. (2)"Revco was in trouble from the day it went private. Sales and earnings projections were strictly from dreamland." [15, p. 46] (3)The examiner wrote that "a basis may exist for a finding of insolvency [at the date of going private] and that a substantial basis exists for establishing that the Revco LBO left Revco with unreasonably small capital to conduct its business and meet its then known obligations." [24, p. 3] (4)See Michel and Shaked [16] for a more detailed explanation of fraudulent conveyance as applied to LBOs. (5)The proxy statement issued the month prior to the LBO cited several reasons why the buying group regarded the purchase of Revco "an attractive investment opportunity": (i) the company's favorable business prospects, (ii) being private would permit Revco to have a higher debt-to-equity ratio than in the past and thus realize higher return on equity and higher growth in net worth; and (iii) the value of Revco depended on long-term expansion of the business rather than on quarterly results, to which public investors give undue attention. (6)CEO Dworkin had been concerned about possible takeover threats [24, p. 30] since April 1984, when the firm's stock price was battered by the sudden announcement by the Food and Drug Administration of a possible link between E-Ferol, a vitamin product, and infant deaths. In the week of the FDA announcement, Revco's market value of equity fell by $160 million, more than twice the $75 million liability that analysts estimated (see Jensen [10]). Dworkin, who owned 2.3% of the firm's common shares, had hoped to pass the reins of top management to his two sons, both of whom were senior vice-presidents of Revco. Within six days of the FDA announcement, Revco announced an agreement to acquire Odd Lot Trading, Inc., a retailer of close-out goods, in an exchange of shares; the transaction put 12% of Revco's new total shares in the hands of two of Dworkin's closest friends, Isaac Perlmutter and Bernard Marden, who were the owners of Odd Lot Trading and who would become officers of Revco. The peace of mind acquired with Odd Lot was short-lived: in less than three months after joining the firm, Perlmutter and Marden found evidence of purchasing irregularities in the firm centering on Elliott Dworkin, one of Sidney's sons. A week later, Perlmutter and Marden announced that they might make a hostile tender offer for the firm, that they wanted 6 of 12 seats on the board of directors, and that they had retained Drexel Burnham Lambert to advise them. Shortly thereafter, the board largely exonerated the purchasing department; Perlmutter and Marden were fired in February 1985; their shares were repurchased by Revco in July 1985. (7)For the five years up to 1984, Revco's sales had grown at a compound annual rate of 19%p earnings per share had grown at about 18%. The stock price had risen 60%, as compared with a 49% increase in the S&P 500 Index. Revco's stock price never recovered, however, from the E-Ferol controversy, the purchase of Odd Lot, and the ensuing management infighting. Nor was the stock price helped by a

decline in the firm's financial performance in 1985 and 1986, when revenues grew, although at a comparatively slow rate, but operating profits declined, which was largely blamed on losses at the new Odd Lot subsidiary. (8)CRSP's equally weighted daily market index was transformed into a time series of monthly returns, which were subtracted from a corresponding series of monthly returns for Revco. The resulting monthly excess returns were cumulated to create the cumulative market-adjusted return series. (9)To assess performance following the LBO, we collected prices for Revco bonds that were outstanding before and after the buyout. Unfortunately, the quality of the date make interpretation difficult, as only monthly prices were available and the bonds traded infrequently. The bond prices do not reveal any clear evidence of wealth transfers at the time of the boyout, but the price did fall steadily afterwards with the decline of the company. (10)Performance deteriorated in 1985 because of unsuccessful price-discounting programs, significant store relocation and remodeling expenses, turmoil in the purchasing, legal fees associated with the dissident directors, and losses associated with an unsuccessful division. (11)Two securities analysts, issuing separate reports, believed the offering price to be 'fair" [20]. Other analysts believed the bid to be too low: William Blair & Company issued a report [15] saying that "$38-40 is more equitable." Also, the Dart Group, operator of a chain of discount drugstores, approached the directors about a possible acquisition of Revco. Later, Dart asked to join the LBO group and threatened to mount a hostile tender offer if excluded. Jamie Securities, a risk-arbitrage boutique, expressed an interest in raising its holding of Revco shares to more than the 9% it already owned. (12)The examiner retained Alex. Brown & Sons to perform a solvency analysis comparing the par value of liabilities to the market value of assets--where market value was determined under three different approaches: comparable market multiples, comparable merger multiples, and discounted cash flow. The challenges in this analysis included the selection of comparable companies, scientifically estimating a discount rate, and accounting for the uncertainty about forecast assumptions. (13)Marine's "reasonable case" assumptions were sales growth varying from 7.0 to 6.5% over five years, and EBDIT margin (earnings before depreciation, interest, and taxes divided by sales) ranging from 5.0 to 7.5% [24, p. 178]. (14)At one point in the report, the examiner reaches a contradictory conclusion. Based on an analysis of debt-service coverage performed by Alex. Brown & Sons, using base-case scenario of 12% revenue growth and 7.7% EBDIT margin, the examiner concluded that Revco "appears to have adequate (emphasis added) capital" [24, p. 177]. This is the only passage in the report that is inconsistent with the examiner's overall conclusion that Revco was undercapitalized. (15)As the debt is paid down in an LBO, the cost of equity must be recomputed to reflect the reduction in financial leverage. One possible escape from this simultaneity problem is to use the value of the actual equity investment as the basis for cost-of-capital estimation. This approach assumes that the dollar outlay equals the market value of equity, which, of course, may not be true. Moreover, it provides no clue as to how the market value of equity will evolve over time. (16)As reported in Exhibit 3, Revco owed a total of $132.5 million in principal payments for the first year following the buyout. Wruck [23] reports only the first payment of $45 million being due. Her error no doubt arose from the fact that $45 million was due in Revco's fiscal year, which ended on May 31, 1987, five months following the buyout. The first full calendar year after the buyout included an additional $87.5 million of principal due on the term loan. Wruck also omits $10.2 million of preferred dividends, which we include as part of the firm's financial obligations. (17)Although not reported here, we also **calculated** an "EBIT Coverage" for each of the three years. EBIT coverage was **calculated** as earnings before interest and taxes divided by projected cash interest and principal payments on long-term debt and cash dividends on convertible preferred stock. These ratios are not reported in the interest of saving

space and because, as an accounting-based number, EBIT coverage is not a true economic predictor of survival, our primary summary statistic. The results are available upon request. (18)Depreciation is computed according to the net effect of the new stores opened (CAPEX) less the existing stores sold (AS). (19)In the course of our research, we uncovered several discrepancies between our estimates of Revco's financial obligations and those reported in the examiner's scenario analyses. In particular, the examiner assumed a faster pay down of debt, lower interest payments, and higher preferred dividend payments. The examiner's report does not provide sufficient detail for us to ascertain the basis of his assumptions in this regard, but our estimates are primarily from the merger prospectus filed December 18, 1986, just 11 days prior to the consummation of the buyout. (20)Customarily, debt prepayments are applied to the last schedule amortization, thus practically preventing Revco from using surplus cash flow in 1987 from prepaying 1988 amortizations. (21)In view of the enormous debt tax shields anticipated by the company, we assume that a tax rate of 0% would apply to any gains on asset sales. (22)Based on an estimate by Ty Eggemeyer, a consultant and retailing executive. (23)The depreciation/amortization estimate equals that reported by Revco for 1986. A critical element in our analysis is the use of the historical average for earnings before interest and taxes (EBIT). The buyout resulted in a substantial increase in depreciation and amortization expenses as a result of purchase accounting and premiums paid over fair value. We used the old depreciation number to avoid invalidating the use of the historical EBIT average. Because the coverage ratios are computed on a pre-tax basis and EBIT is not reduced to reflect the added depreciation expense, only the old depreciation and amortization expense is relevant. (24)The peer group consisted of Jack Eckerd Corp., Fays Inc., Genovese Drug Stores, Perry Drug Stores, Rite Aid Corp., and Walgreen Company. Sales and EBIT data were collected from COMPUSTAT tapes. (25)Kaplan's [13] sample is of management buyouts during 1980-1986. Muscarella and Vetsuypens [17] studied reverse LBOs that occurred through July 1987. In a more recent paper, Kaplan [14] reports that, during the period 1980-1986, the highest realized increase in efficiency for MBOs occurred in 1985, when operating margins grew by 14.3% in the first year following the buyout. (26)We were able to obtain a sample of reverse LBOs from an investment banking firm that wished to remain anonymous. The sample included 12 retailing firms that went public during 1985-1986. The average operating margin for the sample was 6.40%, very close to our 6.60% figure. (27)We disallowed negative interest rates by restricting the minimum prime rate to 2.0%. (28)In the interest of conserving space, we have not reported the results of our sensitivity analysis on the standard deviations of the distributions. None of the standard deviations had a qualitative impact on the probabilities. Because the floating-rate interest payments were such a small part of the total financial obligations, we also chose not to include PRIME in the sensitivity analysis. (29)The buyout was by Eckerd management and an investor group led by Merrill Lynch Capital Partners, Inc., which paid $1.2 billion in cash or $33 per share. Shareholders approved the LBO on April 30, 1986. (30)The GROWTH distribution is identical to that used for Revco. The interest rate on Eckerd's revolving credit loan of $690 million equalled either the prime rate plus 125 basis points or LIBOR plus 250 basis points. Prime at the time of the Eckerd LBO (April 1986) was about 9.0%. Thus, we assumed a base rate of 9.0% for Eckerd as opposed to the rate of 7.5% used for Revco. Detailed results of the Eckerd simulation are available upon request.

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SPECIAL FEATURES: illustration; table; graph
COMPANY NAMES: Revco D.S. Inc.--Acquisitions, mergers, divestments
INDUSTRY CODES/NAMES: BANK Banking, Finance and Accounting
DESCRIPTORS: Leveraged buyouts--Finance; Drugstores--Acquisitions, mergers, divestments
SIC CODES: 5912 Drug stores and proprietary stores
FILE SEGMENT: MC File 75

... year of the LBO (see Wruck [23, Table 2]). We take exception to Wruck's **calculations** , however, because she omits $87.5 million of principal payment due on the term loan...the buyout represent the maximum risk exposure for Revco.(17)

Cash-flow coverage ratio was **calculated** as EBIT (earnings before interest and taxes) plus proceeds from asset sales (AS) less capital...

...AS, and DEPR remain as the stochastic variables needed to compute the coverage ratios. To **calculate** EBIT, we multiplied sales by an EBIT margin

defined as (2) MARGIN = EBIT/SALES. MARGIN...model has been biased downward. Thus, we have biased the survival probability upward with our **calculation** of cash flow and downward with the assumption of independence of cash flows. Although the...0.43*0.45*0.27).

Exhibit 10 is the distribution of the three-year **cash - flow** -coverage **ration** -- i.e., the probability that the sum of the cash flows for 1987-1989 is...as part of the firm's financial obligations. (17)Although not reported here, we also **calculated** an "EBIT Coverage" for each of the three years. EBIT coverage was **calculated** as earnings before interest and taxes divided by projected cash interest and principal payments on...
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  File 610:Business Wire 1999-2004/Oct 27
         (c) 2004 Business Wire.
*File 610: File 610 now contains data from 3/99 forward.
Archive data (1986-2/99) is available in File 810.
  File 810:Business Wire 1986-1999/Feb 28
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  File 634:San Jose Mercury  Jun 1985-2004/Oct 27
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  File 608:KR/T Bus.News. 1992-2004/Oct 29
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  File 475:Wall Street Journal Abs 1973-2004/Oct 28
         (c) 2004 The New York Times
  File  99:Wilson Appl. Sci & Tech Abs 1983-2004/Sep
         (c) 2004 The HW Wilson Co.

      Set  Items  Description
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? s investment (2n) portfolio
         8439592  INVESTMENT
         2229760  PORTFOLIO
      S1  149434  INVESTMENT (2N) PORTFOLIO
? s cash (4n) flow (4n) ration
         4892912  CASH
         3109821  FLOW
           41148  RATION
      S2      41  CASH (4N) FLOW (4N) RATION
? s s2 and calculat?
              41  S2
         2911225  CALCULAT?
      S3       3  S2 AND CALCULAT?
? rd s3
...completed examining records
```

S4 3 RD S3 (unique items)
? t s4/3,k/all

4/3,K/1 (Item 1 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
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05920230 SUPPLIER NUMBER: 12538136 (USE FORMAT 7 OR 9 FOR FULL TEXT)
The crash of the Revco leveraged buyout: the hypothesis of inadequate capital. (Leveraged Buyouts Special Issue)
Bruner, Robert F.; Eades, Kenneth M.
Financial Management, v21, n1, p35(15)
Spring, 1992
ISSN: 0046-3892 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT; ABSTRACT
WORD COUNT: 10497 LINE COUNT: 00846

... year of the LBO (see Wruck [23, Table 2]). We take exception to Wruck's **calculations** , however, because she omits $87.5 million of principal payment due on the term loan...the buyout represent the maximum risk exposure for Revco.(17)

Cash-flow coverage ratio was **calculated** as EBIT (earnings before interest and taxes) plus proceeds from asset sales (AS) less capital...

...AS, and DEPR remain as the stochastic variables needed to compute the coverage ratios. To **calculate** EBIT, we multiplied sales by an EBIT margin defined as (2) MARGIN = EBIT/SALES. MARGIN...model has been biased downward. Thus, we have biased the survival probability upward with our **calculation** of cash flow and downward with the assumption of independence of cash flows. Although the...0.43*0.45*0.27).

Exhibit 10 is the distribution of the three-year **cash - flow** -coverage **ration** -- i.e., the probability that the sum of the cash flows for 1987-1989 is...as part of the firm's financial obligations. (17)Although not reported here, we also **calculated** an "EBIT Coverage" for each of the three years. EBIT coverage was **calculated** as earnings before interest and taxes divided by projected cash interest and principal payments on...

4/3,K/2 (Item 2 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
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05567718 SUPPLIER NUMBER: 11283578 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Horizontal oil and gas wells: the engineering and economic nexus. (engineering parameters and their effect on the economics of horizontal drilling, compared to vertical drilling)
Lohrenz, John
Energy Journal, v12, n3, p35(19)
July, 1991
ISSN: 0195-6574 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT
WORD COUNT: 6790 LINE COUNT: 00562

... q.sub.o,h] to [q.sub.o,v], under the stated assumptions.

An example **calculation** based on the comparison of horizontal and vertical wells already cited with [F.sub.h...D] implies overcoming development difficulties.

Note that the left side of equation (8) is the **ration** of the present value to the undiscounted net **cash flow** . Differentiating equation (8) with respect to D and solving for the maximum [V.sub.D...

4/3,K/3 (Item 1 from file: 20)
DIALOG(R)File 20:Dialog Global Reporter
(c) 2004 The Dialog Corp. All rts. reserv.

24665925 (USE FORMAT 7 OR 9 FOR FULLTEXT)
Reckitt Benckiser - Interim Results
Targets Increased Following Strong First Half
NEW RNS
August 29, 2002
JOURNAL CODE: WRNS LANGUAGE: English RECORD TYPE: FULLTEXT
WORD COUNT: 4908

(USE FORMAT 7 OR 9 FOR FULLTEXT)

... lower capital expenditure, net cash flow from ordinary operations increased by 35% to #264m (#195m).
Cash conversion continued to improve. The **ration** of **cash flow** from operating activities to net revenues increased substantially to 18.6% (14.8%). Net cash...

...H1 2001 31%) treating convertible capital bonds as borrowings.
Earnings per share. Details of the **calculation** of earnings per share are contained in the accompanying notes to the Profit & Loss Account... profit for the half year and the weighted average number of shares used in the **calculations** of the diluted earnings per share are set out below: 2002 2001# Profit Average Earnings...

... the number of Reckitt Benckiser Holdings B.V. "A" shares have been included in the **calculations** of the weighted average number of shares, in order to present the effect of the...

... year and earnings per share on the shares in issue between unadjusted and adjusted EPS **calculation** bases is as follows: 2002 2001# Profit Average Earnings Profit Average Earnings for for Number...
? ds

Set	Items	Description
S1	149434	INVESTMENT (2N) PORTFOLIO
S2	41	CASH (4N) FLOW (4N) RATION
S3	3	S2 AND CALCULAT?
S4	3	RD S3 (unique items)

? t s4/9,k/1

4/9,K/1 (Item 1 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2004 The Gale Group. All rts. reserv.

05920230 SUPPLIER NUMBER: 12538136 (THIS IS THE FULL TEXT)
The crash of the Revco leveraged buyout: the hypothesis of inadequate capital. (Leveraged Buyouts Special Issue)
Bruner, Robert F.; Eades, Kenneth M.
Financial Management, v21, n1, p35(15)
Spring, 1992
ISSN: 0046-3892 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT; ABSTRACT
WORD COUNT: 10497 LINE COUNT: 00846

ABSTRACT: The bankruptcy of Revco Drug Stores is one of the most notable in the history of highly leveraged transactions. This study considers the allegation that the leveraged buyout of Revco left it without adequate

capital to survive. We use Monte Carlo simulation to determine Revco's financial coverage ratios and the expected probability of financial survival. The simulation finds a very low probability that Revco would survive the heavy debt and preferred stock obligations during the first three years following the buyout. The simulation approach provides a useful perspective on the efficacy of the insolvency and capitalization tests as evaluated by the courts. We argue that capital adequacy on the day of going private is extremely difficult to prove using a point-estimate valuation; a simulation-based test provides the more appropriate statistic - i.e., a probabilistic assessment of survival. (Reprinted by permission of the publisher.)

TEXT:

* On July 28, 1988, Revco Drug Stores filed for bankruptcy in what is arguably the most notable failure in the annals of highly leveraged transactions. The firm collapsed merely 19 months after going private, a life span astonishing for its brevity. At closing in December 1986, the leveraged buyout (LBO) was one of the largest ever ($1.4 billion) and, featuring nine discrete layers of securities in the capital structure, was certainly one of the most complex. At bankruptcy, Revco gained distinction as the first "megafailure" among LBOs, a leader in what is by now a long line of prominent collapses, including Campeau (Allied/Federated), Integrated Resources, Ames Department Stores, Circle K. Hillsborough Holdings, and Greyhound. On December 17, 1990, the court-appointed U.S. Bankruptcy Examiner opined that the Revco case revealed "viable causes of action . . . against a broad panoply of defendants under fraudulent conveyance(1) and other legal theories" (Zaretsky [24,p.3]). Notable in the panoply were Revco's financial advisors, and their inclusion was an unprecedented extension of the doctrine of fraudulent conveyance.

Perhaps the most arresting aspect of this case is the allegation made in the financial press,(2) and eventually by the bankruptcy examiner himself,(3) that the leveraged buyout left Revco with an unreasonably small amount of capital. Showing than an LBO rendered a firm inadequately capitalized can be the acid test for applying the principle of fraudulent conveyance in a bankruptcy case.(4) Therefore, the objective of this study is to test the hypothesis of inadequate capital by simulating the financial performance of the company, using financial data on Revco, and comparable companies, that was publicly available on the day Revco went private.

The simulation approach was motivated by Gordon Donaldson's classic application of simulation to corporate debt policy [6]. According to Donaldson, "The answer [about the financial survival of the firm] lies in the behavior of cash flows" [6, p. 164]. Thus, to test the hypothesis of inadequate capital, we tested whether Revco's debt service was too high by estimating means and variances of the major components of cash flow using historical data and forecasts for the industry and for Revco. The resulting model yielded an entire range of cash-flow scenarios and an implied probability of survival.

If the allegations by the bankruptcy examiner and others are simply ex post rationalizations, we would expect the simulations to produce a reasonably high probability of survival. On the other hand, if the simulations reveal a low probability of survival, the results would be consistent with the hypothesis of inadequate capital. Either way, the simulation approach has the virtues of harnessing the information available to analysts at the date of the buyout and casting that information into a probabilistic assessment of survival.

The study offers two principal findings:

(i) Viewed ex ante, Revco had an extremely low probability of successfully servicing its liabilities over the first three years after it went private.

(ii) When compared with historical performance information for Revco and other similar companies, the forecast assumptions used by Revco's

financial advisors were optimistic.

The failure of Revco Drug Stores stands as a provocative counterpoint to much of the previous academic research on LBOs ([2], [3], [4], [11], [12], [13], and [21]).. These studies suggest that the LBO aligns the incentives of managers and shareholders, binds managers to deliver cash to investors, rationalizes internal organization, and reduces costs. Indeed, Revco's proxy statement cited these and other virtues as motives for the LBO,(5) and the examiner's report suggested that some progress was made toward realizing these benefits. In a recent paper, Wruck [23] cited evidence that the investor group overpaid for Revco, but concluded that management's ineptitude was more likely to blame for Revco's failure then how the LBO was structured. With the aid of the simulation results, however, we contend that truly exceptional performance on the part of Revco management would have been necessary to avert the company's demise. Moreover, our conclusions are robust with respect to the assumptions of the parameters of the key variables in the simulation. The same simulation technique applied to Eckerd Drugs, a competitor of Revco that underwent an LBO at about the same time, gives a much higher probability of survival. The respective probabilities of survival for Eckerd and Revco are supportive of the simulation technique, as Eckerd has survived its LBO to date, while Revco has not.

I. The Demise of Revco

The buyout of Revco in 1986 consummated a long episode of anxiety for Sidney Dworkin, Revco's chief executive officer, about possible takeover threats, internal fighting over control of the firm,(6) and declining financial performance.(7) The performance of Revco's common stock over the period 1984-1986 provides a clear picture of how poorly the company performed prior to the 1986 LBO

Exhibit 1 is a graph of monthly market-adjusted returns and cumulative market-adjusted returns(8) (CMAR) for Revco during the period 1984-1986. Shareholders lost significant wealth over 1984-1985, as evidence by the CMAR of -40% at the end of 1985. During 1986, the year of the buyout, shareholders recovered somewhat to an ending CMAR of -23.5%.(9) The effects of several events are identifiable in Exhibit 1. The sharp drop in returns in April 1984 coincides with the government recall of E-Ferol, a vitamin E supplement produced by a Revco subsidiary. Analysts estimated that Revco's liability could mount to $75 million; yet the drop in market value associated with this event was $160 million. Further deterioration in returns later in 1984 is associated with the announcements of worse-than-expected financial performance. The declines in CMAR in February-March 1985 are associated with management changes and the removal of dissident directors. Later in 1985, additional declines are associated wit worsening financial performance and the downgrading of Revco's debt ratings by the major rating agencies.(10)

An independent investment banker first proposed the idea of an LBO to Sidney Dworkin on September 17, 1985. Revco retained Salomon Brothers, Inc., shortly thereafter to advise on the feasibility of an LBO. Salomon rationalized Revco's poor recent financial results as being the result of "temporary problems" [24, p. 36]. Wells Fargo Bank met with Salomon and Revco management on January 24, 1986, to develop a syndicate of banks to provide senior debt in the transaction, and the bank provided a commitment letter in early March 1986.

On Tuesday, March 11, 1986, Dworkin presented a proposal for an LBO to the Revco directors. The proposal called for shareholders to receive $33.00 per share in cash and $3.00 per share in exchangeable preferred, a 17.6% premium over the previous Friday's closing price on the New York Stock Exchange. The LBO announcement produced a two-day (Monday and Tuesday) market-adjusted return of 8.4%. Dworkin's announcement generated a vigorous debate within the financial community regarding the adequacy of the bid,(11) which eventually led him, on June 2, 1986, to present a revised offer to the board of $38.50 in cash. The directors accepted the

offer on August 15th, and Revco stockholders voted to approve the acquisition on December 17, 1986. Revco was taken private on December 29, 1986, at a 48% premium over the firm's stock price 12 months earlier and a 71% premium over the price at which Revco repurchased shares in July 1985.

Through the summer and fall of 1986, Revco's management watched the performance of the firm fall short of budget. Net income for the year that ended May 31, 1986, was down 17.6% from the previous year. During the first quarter of fiscal 1987, June-August 1986, operating income was 21.8% lower than plan. Management attributed the poor results to the entry of new discounters into the discount-drug retailing industry. In October 1986, the operating budget was revised to provide a forecast for use in the prospectus for the LBO's subordinated notes, the proxy statement to shareholders, and the solicitation statement for old the revised holders. As indicated in Exhibit 2, however, even the revised budget was well above Revco's actual performance for fiscal 1987. An internal memo written by Revco's treasurer and dated January 2, 1987 -- four days after the LBO closed -- expressed serious concerns about the firm's worsening cash flows:

> I am very concerned about cash flow since the sales for the past six weeks have been poor resulting in approximately $30 million less cash flow. It will be very difficult to make up this loss of funds. In fact, we have no excess cash going forward. [24, p. 199]

Exhibit 2. Revco Operating Income (in $ Millions) by Quarter for Fiscal Year 1987

	Original Budget	Revised Budget	Actual Results
First quarter (June - Aug. 1986)	$24.5	$19.1	$19.1
Second quarter (Sept. - Nov. 1986)	39.9	24.7	24.6
Third quarter (Dec. 1986 - Feb. 1987)	68.4	66.4	34.7
Fourth quarter (Mar. - May 1987)	56.0	60.8	50.7
Year	$188.9	$171.0	$129.1

Source: Zaretsky [24].

The reports for the four-week and 32-week periods ending January 10, 1987, showed an extremely disappointing Christmas season. What followed was a progressive financial asphyxia that prompted Revco's anxious bankers to meet with company in February and March.

On March 31, 1987, the banks were informed that Dworkin would step down as CEO (although he would remain board chairman), a move that reflected the sentiments of the banks and Salomon that Dworkin "was more entrepreneurial and not experienced or capable of running the operations on a day-to-day basis in a highly leveraged environment" [24, p. 133]. At this same meeting, the banks were informed that progress on asset sales had been delayed, operating income was running below budget, and inventories were over plan. By May 1987, the end of the fiscal year, the situation was such that Revco's new chief financial officer at the time would later state that he believed the firm "was in serious danger of not being able to make debt service payments due in May" [24, p. 137].

On September 25, 1987, Sidney Dworkin agreed to sever his relationship with Revco in return for repurchase of his stock at the price at which he had invested in the LBO, even though the firm had deteriorated in the preceding nine months. Boake Sells, former CEO of Dayton Hudson, took over Dworkin's position. Because of various cash-flow problems, the firm was unable to obtain inventory necessary to stock the stores for the December 1987 Christmas season. As a result, stock-outs were especially severe, and up to 20% of the appropriate inventory was not available in stores.

On March 10, 1988, Salomon's high-yield-bond sales force stopped

making a market for Revco's debt securities. Twelve days later, Salomon deleted Revco from its monthly report, "The Safest of High Yields." At the same time, Boake Sells met with Salomon and expressed his displeasure with the level and quality of Salomon's advisory services.

On April 13th, Salomon presented a restructuring proposal to Revco. Sells rejected it, and after soliciting restructuring proposals from other firms, Revco retained Drexel Burnham Lambert on April 19th to devise a restructuring plan.

On June 16, 1988 Revco missed its first interest payment and omitted a quarterly preferred stock dividend. Drexel appealed to the firm's investors to grant Revco "breathing room." When these appeals were rejected, the firm filed for bankruptcy on July 28, 1988.

II. The Hypothesis of Inadequate Capitalization

To prove fraudulent conveyance in the failure of a leveraged buyout plaintiffs must establish two points. First, they must argue that the firm never received "reasonably equivalent value" from secured lenders in return for giving them a security interest; i.e., that the funds went directly from the lender to the selling shareholders, thus burdening the firm to the detriment of its unsecured creditors. Michel and Shaked [16, p. 43] have argued that this requirement is virtually always met by the structure of the LBO transaction. Second, the plaintiffs must show that, as a result of the LBO, the firm was (i) left insolvent, or (ii) left with "unreasonably small capital."

The test of insolvency considers whether the sum of liabilities at the date of the LBO was greater than the value of the firm's assets. Regarding this test, Wruck [23] concluded: "Assuming the data from Eckerd's LBO provide the best value estimate, it appears the investor group paid somewhere between $200 and $350 million too much for Revco" [23, p. 86]. Kaplan reported a median premium of 42.3% for a sample of 76 management buyouts completed in the period 1980-1986 (see Kaplan [13, Table 2]) and 38.7% for 15 MBOs in 1986 (see Kaplan and Stein [14, Table 1]). For Revco, the premium equalled 48% over the early 1986 price and 71% over the July 198 price. The examiner concluded(12) that "it appears that under most tests Revco would have been solvent, although not in all cases" [24, p. 171]. We argue that the asset valuation required by the solvency test is technically quite difficult and prone to error in the instance of Revco. Instead, we focus on the test of "unreasonably small capital," i.e., whether the LBO rendered the firm incapable of continuing its business and meeting its financial obligations as they became due.

The examiner listed a number of qualitative facts in support of the hypothesis that the Revco deal was economically unattractive. First was insufficient demand by the lenders for the deal: of 33 banks invited to participate in the syndicate, only 11 actually did. Because the initial round of commitments was insufficient to finance the deal, fees to the banks had to be increased to induce them to step up their lending commitments. Second, the appraised asset value of Revco was less than the purchase amount under certain assumptions. Third, although other bidders were rumored to be preparing offers, in fact none appeared to top Dworkin's bid. Fourth, Moody's and Standard & Poor's, the rating agencies, declared Revco's LBO to have a "negative outlook" more than a month before the deal was consummated. Fifth, internal bank memoranda acknowledged that the firm would survive only with aggressive asset sales. And finally, the performance of the firm had been declining to the point, in the fall of 1986, of necessitating a rebudgeting of fiscal year 1987.

In addition to the qualitative evidence, the examiner's report cited financial analyses prepared by Midland Bank and Alex. Brown & Sons as quantitative support of the inadequate capitalization hypothesis. A "reasonable case" scenario prepared by Marine Midland Bank(13) led the examiner to conclude that Revco would be unable to meet its cash requirements starting in 1989. Further scenario analysis by Alex. Brown & Sons projected financial difficulty in 1988, 1989, and 1990 which prompted

the examiner too conclude that "a strong case can be made that Revco was left with unreasonably small capital as a result of the Revco LBO" [24, p. 196].(14)

From a financial economic point of view, however, the formal analyses and other evidence provided by the examiner leave much to be desired. The discounted-cash-flow (DCF) method of valuation was the primary method used by the examiner to test for insolvency. Applying the DCF technique to a highly levered transaction is difficult to do correctly, however, because of an inherent simultaneity problem: the market value of equity is needed to compute the cost of equity, which, in turn, is needed to compute the market value of equity.(15) The examiner's report does not disclose now this simultaneity problem was addressed. Moreover, even if the analysis is done correctly, comparison of values of assets and debt at the date of going private sheds no light on the timing, probability, or severity of default at some date in the future. In other words, if any test of insolvency or inadequate capitalization is to be informative, it must embody the uncertainty surrounding the forecast assumptions in a meaningful manner. The examiner's report strives to incorporate uncertainty through scenario analyses. The various scenarios considered leave the reader with no appreciation for the likelihood of default, however, and it is the prospect of default, not a few expected values, in which the creditors, management, and equity investors should be interested.

The only academic research specific to Revco was conducted by Wruck [23]. Although citing evidence that the Revco LBO was overpriced, Wruck also argued that the financial obligations could have been met were it not for the poor performance of Salomon in executing the disposition of certain assets. To illustrate her point, Wruck reported that, based on management's forecasts, only six percent of the assets needed to be sold to service the scheduled interest and principal payments for the first year of the LBO (see Wruck [23, Table 2]). We take exception to Wruck's **calculations** , however, because she omits $87.5 million of principal payment due on the term loan in the first calendar year.(16) With the inclusion of this payment, Wruck would have concluded that 44% (60% on the basis of actual results) of the total asset sales were necessary for Revco to survive the first year. More fundamentally, however, we take Donaldson's [6] position that point estimates for a single year cannot be used to assess survival probabilities accurately over a period of years. Only by considering all the moments of the components of cash flow and the cumulative effects of successive years of obligations can we hope to interpret accurately coverage ratios such as those reported by Wruck [23]. In addition, both Wruck and the examiner leave important questions unanswered about the timing, probability, and severity of a default. The answers to these questions offer better insight into the adequacy and reasonableness of the buyout. Thus, we address the examiner's allegation of inadequate capitalization as a testable hypothesis using simulation analysis.

III. A Simulation Approach to Estimating Revco's Probability of Default

Following Donaldson's [5] illustration of Monte Carlo simulation as applied to the evaluation of cash-flow adequacy, we use Monte Carlo simulation to test the ability of Revco to cover its annual cash obligations; in particular, we use the technique to yield an estimate of the probability of successfully covering the firm's cash interest, debt principal, and preferred dividend payments over the first three calendar years following the buyout. At issue is the sensitivity of the probability of survival based on variations in the operating assumptions used by Revco and Salomon versus assumptions consistent with the historical performance of comparable companies and Revco.

A. The Variables

The simulation model forecasts a cash-flow debt-service coverage ratio ("CF Coverage") for 1987, 1988, and 1989, the first three years following the LBO. Revco used a fiscal year end of May, 31, but, because

the LBO was consummated on December 29, 1986, we adopted the convention of using the calendar year as the first year to coincide with the LBO date. Thus, each of the projected years contains 12 months of sales covering the calendar years 1987, 1988, and 1989. The structure of the financing makes a longer forecast period unnecessary, because the first three years following the buyout represent the maximum risk exposure for Revco.(17)

Cash-flow coverage ratio was **calculated** as EBIT (earnings before interest and taxes) plus proceeds from asset sales (AS) less capital expenditures on new stores (CAPEX) plus depreciation (DEPR),(18) divided by cash interest payments (INT) plus principal payments (PRIN) plus cash dividends (DIV), i.e., (1) CF Coverage = (EBIT + AS - CAPEX + DEPR/(INT + [PRIN + DIV) The ratios were modeled in a Lotus 1-2-3 spreadsheet and simulated with 200 iterations using "@RISK" simulation software.

For the most part, Revco's financial obligations (INT, PRIN, and DIV) were known at the time of the buyout and were, therefore, entered in the model as fixed numbers. Exhibit 3 summarizes Revco's cash payment obligations for the simulation period, 1987-1989. Interest on fixed-coupon debt, principal, and preferred dividend payments was determined according to the schedules reported in Securities and Exchange Commission (SEC) filings [1], [20]. Only cash payments were included in the simulation; no consideration was given to noncash obligations such as payment-in-kind (PIK) preferred stocks. Of the three preferred issues used in the buyout, two, the 15.25% cumulative exchangeable and the 17.62% cumulative junior preferred, were PIKs. The 12.0% cumulative convertible preferred stock with a face value of $85 million is responsible for the $10.2 million of preferred dividends reported in Exhibit 3.(19)

Reported separately in Exhibit 3 are fixed- and floating-rate interest payments. Of the $1,331 million of debt used in the LBO, $455 million had a floating interest rate, and the remaining $876 million had fixed rates. The fixed-rate debt obligations had an average interest rate of 12.9% with no principal payments due during the study period. The term loan was structured in such a way that Revco could choose interest payments as either 1.75% over the prime rate or 2.75% over LIBOR (London Interbank Offer Rate). The floating interest payments reported in Exhibit 3 assume that the prime-rate option is chosen and that prime remains at the December 1986 rate (7.50%) for the entire three years. The only payments of principal during the study period are for the term loan, as specified by its amortization schedule. Thus, the floating interest payments decline over time as the term loan is retired, whereas the fixed interest payment remains constant at $112 million. To simulate the floating-rate interest payments, we modeled all the prime rate (PRIME) as a normal distribution with mean equal to the December 1986 rate of 7.50% and a standard deviation of 3.60%, as estimated from historical data.

Exhibit 3. Revco's Financial Obligations for 1987-1989
(in Thousands)

	1987	1988	1989
Principal payments	$132,500	$152,500	$ 70,000
Fixed interest payments	112,802	112,802	112,802
Floating interest payments	42,088	29,831	15,725
Preferred dividends	10,200	10,200	10,200
Total cash obligation	$297,590	$305,336	$208,727

Sources: [1], [20].

EBIT, AS, and DEPR remain as the stochastic variables needed to compute the coverage ratios. To **calculate** EBIT, we multiplied sales by an EBIT margin defined as (2) MARGIN = EBIT/SALES. MARGIN was modeled as normal with mean and variance estimated from historical performance data for Revco and other comparable companies.

The sale of existing stores and other assets (AS) was modeled as the appraisal figure given in the prospectus ($230 million). Consistent with the prospectus, we assumed that the company could realize 100% of the divestiture proceeds during the first two years of the LBO. AS for 1987 was

assumed to be uniformly distributed over 25 to 75%; i.e., the model assumed that Revco could sell with equal probability anywhere from $57.5 million to $172.5 million of the $230 million of assets in the first year. For 1988, the second year after the buyout, AS equals the $230 million less the realization of 1987 asset sales. Because of holding the total asset sales constant at $230 million, the only uncertainty introduced into the model is the timing of the asset sales.

We modeled AS as described for several reasons. Unlike most other variables in the analysis, no historical data exist to guide us in the modeling of AS. The lack of data makes our modeling choices for AS somewhat arbitrary and, hence, easy prey to criticism. Faced with such a challenge, we chose to model AS in a way that the model would be biased in favor of finding a high survival probability. The first step in this direction was to assume, as Revco did at the time, that Salomon Brothers would be able to sell the assets with the first two year following the LBO. In our view, this assumption represents a best-case scenario for Revco.

The second step was to recognize that allowing the total amount of asset sales to vary around $230 million would, in fact, act to reduce Revco's computed probability of survival. As was true for most LBOs, the Revco financial structure contained a covenant in the term loan that required any excess proceeds of the divestiture to be used as prepayments(20) of the loan. Thus, if Revco should happen to be lucky enough to realize more than the $230 million for the assets at the end of the second year, the extra cash could not be used to service and third year's cash flow obligations. Rather, the money would have to be used as a prepayment of the term loan, which would only slightly reduce the interest payments in the third year. On the other hand, if Revco should realize a shortfall in the sale of the assets, the reduced inflow would significantly reduce the firm's ability to service its obligations in the first and/or second years. The overall effect of allowing the $230 million figure to vary is that the downside fluctuations hurt the survival of the LBO more than the upside fluctuations help it. Thus, our assumptions about AS are conservative and bias the model toward the conclusion that the LBO would succeed. Moreover, the examiner's report reveals [24, p. 151] that Revco's actual sales were approximately 14% under expectations, making our assumptions (expost) somewhat optimistic.(21)

An offset to AS is CAPEX, the outlay required for starting new stores each year. To model this variable, we assumed new stores would open at a rate of 100 per year, consistent with the goals stated in the prospectus. We assumed that $100,000 per store would cover the investment in fixtures, systems, an other assets unrelated to inventory and that, consistent with Revco's past practice, new store buildings and land would be leased.(22) As new stores are added and existing stores sold in the model, total revenue is adjusted according to the assumed sales-per-year figure. Consistent with historical performance, new and mature stores' annual sales for 1987 were assumed to be $945,000 and $1,015,000, respectively. These sales figures are increased each year by a growth rate (GROWTH), assumed to be inflation, which was modeled as a normal distribution with a mean of 5.0% and standard deviation of 3.90% as measured from a time series of historical inflation rates. Depreciation expense (DEPR) was approximated as $33.7 million for 1987 and was scaled according to the percentage net change of (AS - CAPEX).(23)

B. Parameters of the Distributions

The parameters of MARGIN were estimated using historical EBIT data for Revco and a six-firm peer group from the drugstore retailing industry. Complete EBIT data were available for the sample of drugstore firms for the period 1974-1986. To maintain consistency in the estimation process, we used the same estimation period to estimate the means and variances of GROWTH and PRIME.

Exhibit 4 summarizes the results of our estimation procedure for the parameters of MARGIN, GROWTH, and PRIME. The sample distribution of each

variable was tested against the null hypothesis of being normal using the Kolmogorov-Smirnov (KS) goodness-of-fit test. None of the KS tests produced Z-scores significantly different from zero at conventional probability levels. The KS test results suggest that our assumptions of normality are reasonable. The results do not tell us, however, whether the historical MARGIN mean of 6.60% is a reasonable estimate of Revco's future performance at the time of the buyout in 1986. In truth, the final choice of a mean is a subjective process that can always be debated. As a beginning point, however, we review the estimates made by the major players in the deal.

The examiner's report reveals strongly contrasting views among insiders and outsiders about Revco's future performance. Salomon and Revco advocated operating assumptions that others deemed aggressive in light of the performance of comparable companies and Revco's own operating history. The examiner noted that the lowest sales growth are contemplated by Salomon was 8%, while the lowest EBIT margin used was 6.5% [24, p. 34]. The agent bank in the buyout, Wells Fargo, ran a worst-case scenario [24, p. 42] assuming 8% sales growth (5% growth of new stores plus 3% inflation), whereas the investor group provided its banks with forecasts assuming 12% total sales growth. Goldman Sachs, the advisor to Revco's outside directors, determined that a 12% growth-rate assumption was "too aggressive" (a more reasonable assumption was 8%) and that the assumption of a 7.7% gross margin was "a bit aggressive" [24, pp. 52, 53]. Ironically, Goldman ultimately opined that the investor group's projections were "realistically attainable" [24, p. 54].

Part of Revco's sales growth rate depended on the rate at which it planned to open new stores. The company's plan to open 100 new stores per year for the first five years was intended to discourage new entry by competitors into Revco's market areas [20, p. 11]. The wisdom of the aggressive expansion strategy is questionable, however, in light of the resulting drag on operating performance. The examiner noted that 70% of Revco's stores that were open less than one year lost money; the figure dropped to 48% for stores opened between one and two years [24, p. 42].

Our base-case assumptions for the Monte Carlo simulations are compared with the assumptions used by Revco and Salomon Brothers in Exhibit 5. The numbers differ in a couple of critical areas. In particular, our EBIT margin of 6.60% is much more conservative than Salomon's 8.0%. Exhibit 6 displays the time series of EBIT margin (MARGIN) for Revco and the six-firm peer group.(24) The exhibit shows that Revco's average margin for the period was 28% higher than the peer group (6.60% versus 5.15%), but Revco's performance in 1985 and 1986 (margins of 3.50 and 4.84%) was clearly below the long-run average. Revco's peak performance occurred in 1984 when MARGIN reached 8.14%, the only year in which EBIT reached the 8.0% level assumed by Salomon Brothers.

Exhibit 5. Monte Carlo Versus Revco/Salomon Valuation Assumptions

	Monte Carlo Base-Case Assumptions	Revco/Salomon Assumptions(*)
MARGIN, mature stores	6.60%	8.0%
Standard deviation	1.32%	NA
MARGIN, new stores	6.60%	NA
Standard deviation	1.32%	NA
Corporate less growth	NA	12%
Growth rate of sales per store	5.00%	NA
Standard deviation of store Sales growth rate	3.90%	NA
Number of new stores opened per year (CAPEX)	100	100
Floating interest rate Prim + 1.75%	9.25%	10.25%
Standard deviation of prime	3.60%	NA

(*)Source: Zaretsky [24].

These numbers reveal that a 6.60% mean implies a 40% improvement over Revco's performance for the most recent two years (averaged MARGIN of 4.17%) and that Salomon's 8.0% MARGIN represents a 92% increase over the 1984-1985 average MARGIN. These increases in efficiency are much larger than those reported by Kaplan [13] and Muscarella and Vetsuypens [17], who found that margins increase by a total of approximately 19% over the three years following a buyout.(25) All things considered, we judge a 40% improvement in efficiency, as represented by the 6.60% margin, to be a generous expectation in the case of Revco's management.(26)

For the standard deviation of MARGIN, we used 1.32%, the historical standard deviation of Revco's MARGIN for the 13-year time series. The average variance for the six peer companies over the same 13 years equated to a 1.25% standard deviation. Thus, while Revco's mean MARGIN was higher than the peer group, its standard deviation of MARGIN was approximately the same, which supports our choice of Revco's historical volatility for the base case.

For sales growth, we assumed sales per store would grow at an inflation rate of 5% and that new stores would be opened at the rate of 100 per year, less any stores sold. The combination of the 5% inflation growth plus the net growth of new stores is equivalent to an annual corporate sales growth rate of about 9% over the three years, noticeably smaller than Salomon's assumption of 12% growth. Our growth figure appears justifiable, because store growth is modeled as projected by the company, and our perusal of Revco's sales growth revealed no evidence that sales per store should grow faster than inflation in the late 1980s.

Inflation was modeled as a normal distribution with mean 5.0% and standard deviation of 3.90%. Given the low interest rates at the time (Treasury bills had consistently averaged under 6% since June 1986), an expectation of 5% inflation seems generous. Although our overall growth assumption is more conservative than Salomon's, the relevant issue is the influence of the assumption on the results, which our sensitivity analysis revealed to be negligible.

The prime rate was modeled to capture the effect of the floating-interest provision of the term loan. Prime was 7.50% in December 1986, implying a term-loan rate at the time of 9.25%, prime plus 175 basis points. Revco was allowed to reset the interest rate as often as monthly or as infrequently as semiannually. For convenience, and to maintain consistency with the annual data used to estimate the parameters, we assumed the prime rate to be normally distributed and reset at the beginning of each year. As reported in Exhibit 4, the standard deviation of the prime rate had been 3.60% for the period 1974-1986. Thus, PRIME was modeled as normal with mean equal to 7.50% and standard deviation of 3.60%.(27)

No model can be an exact representation of reality. Regarding this model, we offer a couple of caveats. First, our simulation analysis ignores the effect of taxes, capital improvements to the mature stores, accounts receivable and inventory growth, and interest on seasonal debt. The inclusion of any of these factors, however, would have served only to depress the cash flow coverage ratios and decrease the estimated probability of survival relative to the nominal performance as reported here. Second, our base model assumes no covariance between growth and margins, and it assumes that each year is an independent draw, i.e., there is no serial covariance in MARGIN, GROWTH, or PRIME from year to year. Although not reported here, we found no qualitative difference in our results when we assumed each variable to be a random-walk process with the previous year's outcome being the mean of the current year's distribution. A potentially more important serial covariance problem, however, is that induced by the action of management. For example, if cash flows in 1987 were running behind schedule, management could push to accelerate the asset divestitures to offset the expected shortfall. To the extent that

management responds in this manner, the probability of survival as computed by our model has been biased downward. Thus, we have biased the survival probability upward with our **calculation** of cash flow and downward with the assumption of independence of cash flows. Although the net effect of these two biases is not apparent, the covariance bias can be neutralized fairly easily.

Rather than attempt the unwieldy task of modeling all the possible interactive effects, we computed a second probability of survival that allows for complete interaction between the cash flows occurring during the first three years. The "three-year" probability was computed by assuming that the sum of the cash flows for 1987-1989 would be available to service the sum of the financial obligations for the period. In other words, a bad draw in one year would not necessarily lead to ruin if the other two draws were large enough to make up the deficit. This is equivalent to assuming that management can carry forward any excess cash flows as well as borrow costlessly from future excess cash flows. Hence, whereas the net bias of the independent survival probabilities is not apparent, the three-year probability is obviously biased upward and represents an upper bound on Revco's probability of survival.

IV. Results

To illustrate the inputs and outputs of the model, Exhibit 7 presents a series of histograms of variable distributions as modeled for 1987, the first year following the LBO. The histogram in Panel A is a depiction of the EBIT distribution, which is a product of MARGIN and total revenue. Total revenue equals the number of mature stores times sales per mature store plus the number of new stores times the new-store sales rate. The vertical dashed line represents the mean, which is reported at the top of the y-axis as $149.2 million. The histogram's bell shape reflects the dominating influence of modeling MARGIN as a normal distribution. Panel B contains the asset sales (AS) distribution for 1987. The approximately equal bars reflect the assumption that AS is uniformly distributed over the interval {$57.5, $172.5} million with a mean of $115 million. EBIT plus net depreciation and AS equals "cash flow available," which is depicted in Panel C. Cash flow available is the numerator of Equation (1); i.e., the cash available for new-store investments and servicing financial obligations. Because Revco's total financial servicing obligation for 1987 was $297.6 million (see Exhibit 3) and the mean cash flow available is $288.7 million, the implied average CF coverage ratio for 1987 is 0.97, exactly equal to that reported in Exhibit 8 for the 1987 base case.

Exhibit 9 displays the CF coverage ratio distributions for 1987, 1988, and 1989. For these base-case scenarios the mean coverage ratios are 0.97 in 1987, 0.98 in 1988, and 0.96 in 1989. The mass of the distribution to the right of 1.0 represents the probability of surviving a given year. Thus, the cumulative probability of survival is computed as the product of each of the three annual probabilities of realizing a ratio greater than 1.0. For the base case, the three annual probabilities of survival are 0.43, 0.45, and 0.27, and the cumulative probability of survival is 0.052 (0.43*0.45*0.27).

Exhibit 10 is the distribution of the three-year **cash - flow** -coverage **ration** -- i.e., the probability that the sum of the cash flows for 1987-1989 is sufficient to cover the sum of the obligations for the period. This ratio assumes that past and future cash flows are available to service the financial obligations for any year. Thus, the ratio represents a best-case measure of the model's estimate of Revco's ability to pay. The area to the right of 1.0 is the probability of survival. Because the ratio has a mean less than 1.0(0.97) and the variance of the distribution is small, the probability of survival is approximately 30%, much larger than the product of the three independent-year probabilities computed using the Exhibit 5 distributions equal to 5.2%.

To test the robustness of the model to our assumptions, we performed two comparisons. First, we conducted a sensitivity analysis on the means of

the stochastic variables.(28) As revealed in Exhibit 10, the coverage ratios for Revco are consistently less than 1.0, and the probability of successful coverage remains low regardless of variations in assumptions for MARGIN, GROWTH, and STORES (the number of new-store openings per year). Increasing the expected EBIT margin to Salomon's assumption of 8.0% results in a probability of survival of 48%, the highest cumulative probability produced in the sensitivity analysis.

The three-year ratio probabilities in Exhibit 8 are consistently higher than the cumulative independent probabilities for the three years. For example, the base-case probability is 30% for the three-year ratio compared to only 5% assuming independent cash flows. The reader should keep in mind that the three-year ratio is a strong upwardly biased measure of survival and that the base-case probability of 30% is, in itself, a very low survival probability. The three-year probability rises to 94% if Salomon's MARGIN of 8.0% is used, but for every other scenario reported in Exhibit 8, the three-year probability is 40% or less. Interestingly, when MARGIN is assumed to equal Revco's average performance for 1984-1985 of 4.17%, the probability of survival is virtually zero under either probability measure. Thus, with the exception of assuming MARGIN to equal 8.0%, the model yields consistently low survival probabilities for Revco.

As a second check of the model's robustness, we applied the simulation to the Jack Eckerd Corporation, one of Revco's competitors in discount-drugstore retailing and itself the subject of a leveraged buyout in 1986.(29). As with Revco, we used historical performance data as the basis for EBIT projections and SEC filings [7] for financial obligation projections. Over the period 1974-1986, Eckerd's MARGIN averaged 8.11% with a standard deviation of 1.42% compared to Revco's 6.60% and 1.32%. A more important difference from Revco, however, was that Eckerd's interest and principal payment schedules were substantially deferred. The simulations for Eckerd produced coverage ratios of 1.30, 1.35, and 1.40 for the first three years following the buyout. These individual probabilities imply a cumulative probability of survival of 95% and a three-year probability of 95% also.(30)

V. Conclusion and Implications

The analysis in this study suggests that Revco had a probability of between 5 and 30% of successfully servicing its financial obligations in the first thee years after going private. These survival possibilities are so low as to suggest that Revco was undercapitalized in the sense that the new debt obligation exceeded its expected cash flow and hence, the buyout was doomed to fail from the start. It is only when Revco's earning power is assumed at almost double that of its recent past that the survival probability (assuming independence of cash flows) approaches 50%. The survival probabilities are relatively insensitive to assumptions concerning asset sales and growth of sales suggesting that it was the leveraged buyout and the restructuring strategy rather than flawed execution of the strategy by management that drove Revco down. Ironically, the strategy of the newly private Revco was to focus on asset sales and growth, and only secondarily to focus on profitability. The deteriorating environment for retailers in late 1987 and 1988 could be chalked up as bad luck, but we believe the hallmark of a good strategy is the ability to withstand unforeseen adversities. We leave it for others to speculate as to why the deal was consummated.

A simulation-based research methodology, such as that used here, has its weaknesses. Our strategy has been to address the weaknesses by stating them plainly and then to construct the model so that it is based in favor of survival. The base-case assumptions were reasonable in that they were consistent with information a financial analyst would have had in December 1986, when Revco went private. Other assumptions for which there was no strong base of public information or historical experience (e.g., tax exposure, asset sales, working capital requirements) were tilted in Revco's favor. Despite the model being biased in favor of survival, however, we

consistently found low survival probabilities and conclude that they arise because of Revco's onerous payment schedule and anemic earning power rather than as an artifact of our methodology. Our sensitivity analysis revealed that even granting the optimistic assumptions used by Revco's financial advisers and bankers produces survival probabilities of less than 50%. Indeed, no set of forecast assumptions surveyed in the bankruptcy examiner's report gave high probabilities of survival. In addition, testing our methodology on another drug retailer taken private at about the same time, Jack Eckerd Corporation, produced high probabilities of survival. In other words, our ex ante approach produced results that are consistent to date with the fates of Revco and Eckerd. Thus, we conclude that the model discriminates reasonably well and is not prone to predict disaster for every LBO.

The primary implication of this study for research on LBOs is that terms of financing matter and warrant scholarly attention. Finance researchers have to date given more attention to the operating aspects in LBOs than to the terms of financing. By "terms of financing," we mean the detailed financial design of the buyout, including the time series of debt service obligations and the underlying terms of the different layers of capital. There is virtually no scholarly work in print on the rich variation in financial design from one buyout to the next. Why, for instance, were the time series of debt service obligations so different for Revco and Jack Eckerd which are fairly similar companies?

The primary implication of this study for jurists, legislators, and practitioners in finance is that "capital adequacy" has less to do with the amount and mix of types of capital and more to do with the firm's expected cash flow and the time profile of debt service obligations. This is consistent with Donaldson's [6, p. 150] conclusion that,

> ... widely used rules of thumb which evaluate debt capacity in terms of some percentage of balance sheet values or in terms of income statement ratios can be seriously misleading and even dangerous to corporate solvency ... debt policy in general and debt capacity in particular cannot be prescribed for the individual company by outsiders or by generalized standards; rather they can and should be determined by management in terms of individual corporate circumstances and objectives and on the basis of the observed behavior of patterns of cash flows.

The public policy debates over leveraged buyouts have been sprinkled with reference to the high debt-equity ratios typical of these deals; but such statistics are weak indicators of risk. An economic test of buyout risk or fraudulent conveyance should look to the probability of survival, though we admit that a precise measurement of this probability is difficult. Moreover, there are no standards by which an objective observer can parse out expected survivors from expected mortalities. In cases of very low probability of survival like Revco, however, the test of capital adequacy is intuitively easy: only upon extremely optimistic expectations could one have predicted that Revco's financial obligations would be manageable.

In sum, the provocative findings of this study invite more scholarly and applied research on the capitalization of firms. Based on our experience in conducting this study, we conclude that the richest insights in this area are bound to come from the analysis of individual cases of small samples of firms. (1)In the law (i.e., the Bankruptcy Code, the Uniform Fraudulent Conveyance Act (UFCA) and its successor, the Uniform Fraudulent Transfer Act (UFTA)), a fraudulent conveyance is a transfer of property the object of which is to defraud or delay an unsecured creditor or alienate the property from his reach. Where courts find fraudulent conveyance, the liens and security interests of the secured lenders may be set aside and collateral subordinated to the unsecured lender. In the Revco

case, the examiner considered the financial advisors, accountants, bank lenders, and even shareholders as possible targets of attack under the theory of fraudulent conveyance. (2)"Revco was in trouble from the day it went private. Sales and earnings projections were strictly from dreamland." [15, p. 46] (3)The examiner wrote that "a basis may exist for a finding of insolvency [at the date of going private] and that a substantial basis exists for establishing that the Revco LBO left Revco with unreasonably small capital to conduct its business and meet its then known obligations." [24, p. 3] (4)See Michel and Shaked [16] for a more detailed explanation of fraudulent conveyance as applied to LBOs. (5)The proxy statement issued the month prior to the LBO cited several reasons why the buying group regarded the purchase of Revco "an attractive investment opportunity": (i) the company's favorable business prospects, (ii) being private would permit Revco to have a higher debt-to-equity ratio than in the past and thus realize higher return on equity and higher growth in net worth; and (iii) the value of Revco depended on long-term expansion of the business rather than on quarterly results, to which public investors give undue attention. (6)CEO Dworkin had been concerned about possible takeover threats [24, p. 30] since April 1984, when the firm's stock price was battered by the sudden announcement by the Food and Drug Administration of a possible link between E-Ferol, a vitamin product, and infant deaths. In the week of the FDA announcement, Revco's market value of equity fell by $160 million, more than twice the $75 million liability that analysts estimated (see Jensen [10]). Dworkin, who owned 2.3% of the firm's common shares, had hoped to pass the reins of top management to his two sons, both of whom were senior vice-presidents of Revco. Within six days of the FDA announcement, Revco announced an agreement to acquire Odd Lot Trading, Inc., a retailer of close-out goods, in an exchange of shares; the transaction put 12% of Revco's new total shares in the hands of two of Dworkin's closest friends, Isaac Perlmutter and Bernard Marden, who were the owners of Odd Lot Trading and who would become officers of Revco. The peace of mind acquired with Odd Lot was short-lived: in less than three months after joining the firm, Perlmutter and Marden found evidence of purchasing irregularities in the firm centering on Elliott Dworkin, one of Sidney's sons. A week later, Perlmutter and Marden announced that they might make a hostile tender offer for the firm, that they wanted 6 of 12 seats on the board of directors, and that they had retained Drexel Burnham Lambert to advise them. Shortly thereafter, the board largely exonerated the purchasing department; Perlmutter and Marden were fired in February 1985; their shares were repurchased by Revco in July 1985. (7)For the five years up to 1984, Revco's sales had grown at a compound annual rate of 19%p earnings per share had grown at about 18%. The stock price had risen 60%, as compared with a 49% increase in the S&P 500 Index. Revco's stock price never recovered, however, from the E-Ferol controversy, the purchase of Odd Lot, and the ensuing management infighting. Nor was the stock price helped by a decline in the firm's financial performance in 1985 and 1986, when revenues grew, although at a comparatively slow rate, but operating profits declined, which was largely blamed on losses at the new Odd Lot subsidiary. (8)CRSP's equally weighted daily market index was transformed into a time series of monthly returns, which were subtracted from a corresponding series of monthly returns for Revco. The resulting monthly excess returns were cumulated to create the cumulative market-adjusted return series. (9)To assess performance following the LBO, we collected prices for Revco bonds that were outstanding before and after the buyout. Unfortunately, the quality of the date make interpretation difficult, as only monthly prices were available and the bonds traded infrequently. The bond prices do not reveal any clear evidence of wealth transfers at the time of the boyout, but the price did fall steadily afterwards with the decline of the company. (10)Performance deteriorated in 1985 because of unsuccessful price-discounting programs, significant store relocation and remodeling expenses, turmoil in the purchasing, legal fees associated with the

dissident directors, and losses associated with an unsuccessful division. (11)Two securities analysts, issuing separate reports, believed the offering price to be 'fair" [20]. Other analysts believed the bid to be too low: William Blair & Company issued a report [15] saying that "$38-40 is more equitable." Also, the Dart Group, operator of a chain of discount drugstores, approached the directors about a possible acquisition of Revco. Later, Dart asked to join the LBO group and threatened to mount a hostile tender offer if excluded. Jamie Securities, a risk-arbitrage boutique, expressed an interest in raising its holding of Revco shares to more than the 9% it already owned. (12)The examiner retained Alex. Brown & Sons to perform a solvency analysis comparing the par value of liabilities to the market value of assets--where market value was determined under three different approaches: comparable market multiples, comparable merger multiples, and discounted cash flow. The challenges in this analysis included the selection of comparable companies, scientifically estimating a discount rate, and accounting for the uncertainty about forecast assumptions. (13)Marine's "reasonable case" assumptions were sales growth varying from 7.0 to 6.5% over five years, and EBDIT margin (earnings before depreciation, interest, and taxes divided by sales) ranging from 5.0 to 7.5% [24, p. 178]. (14)At one point in the report, the examiner reaches a contradictory conclusion. Based on an analysis of debt-service coverage performed by Alex. Brown & Sons, using base-case scenario of 12% revenue growth and 7.7% EBDIT margin, the examiner concluded that Revco "appears to have adequate (emphasis added) capital" [24, p. 177]. This is the only passage in the report that is inconsistent with the examiner's overall conclusion that Revco was undercapitalized. (15)As the debt is paid down in an LBO, the cost of equity must be recomputed to reflect the reduction in financial leverage. One possible escape from this simultaneity problem is to use the value of the actual equity investment as the basis for cost-of-capital estimation. This approach assumes that the dollar outlay equals the market value of equity, which, of course, may not be true. Moreover, it provides no clue as to how the market value of equity will evolve over time. (16)As reported in Exhibit 3, Revco owed a total of $132.5 million in principal payments for the first year following the buyout. Wruck [23] reports only the first payment of $45 million being due. Her error no doubt arose from the fact that $45 million was due in Revco's fiscal year, which ended on May 31, 1987, five months following the buyout. The first full calendar year after the buyout included an additional $87.5 million of principal due on the term loan. Wruck also omits $10.2 million of preferred dividends, which we include as part of the firm's financial obligations. (17)Although not reported here, we also **calculated** an "EBIT Coverage" for each of the three years. EBIT coverage was **calculated** as earnings before interest and taxes divided by projected cash interest and principal payments on long-term debt and cash dividends on convertible preferred stock. These ratios are not reported in the interest of saving space and because, as an accounting-based number, EBIT coverage is not a true economic predictor of survival, our primary summary statistic. The results are available upon request. (18)Depreciation is computed according to the net effect of the new stores opened (CAPEX) less the existing stores sold (AS). (19)In the course of our research, we uncovered several discrepancies between our estimates of Revco's financial obligations and those reported in the examiner's scenario analyses. In particular, the examiner assumed a faster pay down of debt, lower interest payments, and higher preferred dividend payments. The examiner's report does not provide sufficient detail for us to ascertain the basis of his assumptions in this regard, but our estimates are primarily from the merger prospectus filed December 18, 1986, just 11 days prior to the consummation of the buyout. (20)Customarily, debt prepayments are applied to the last schedule amortization, thus practically preventing Revco from using surplus cash flow in 1987 from prepaying 1988 amortizations. (21)In view of the enormous debt tax shields anticipated by the company, we assume that a tax rate of

0% would apply to any gains on asset sales. (22)Based on an estimate by Ty Eggemeyer, a consultant and retailing executive. (23)The depreciation/amortization estimate equals that reported by Revco for 1986. A critical element in our analysis is the use of the historical average for earnings before interest and taxes (EBIT). The buyout resulted in a substantial increase in depreciation and amortization expenses as a result of purchase accounting and premiums paid over fair value. We used the old depreciation number to avoid invalidating the use of the historical EBIT average. Because the coverage ratios are computed on a pre-tax basis and EBIT is not reduced to reflect the added depreciation expense, only the old depreciation and amortization expense is relevant. (24)The peer group consisted of Jack Eckerd Corp., Fays Inc., Genovese Drug Stores, Perry Drug Stores, Rite Aid Corp., and Walgreen Company. Sales and EBIT data were collected from COMPUSTAT tapes. (25)Kaplan's [13] sample is of management buyouts during 1980-1986. Muscarella and Vetsuypens [17] studied reverse LBOs that occurred through July 1987. In a more recent paper, Kaplan [14] reports that, during the period 1980-1986, the highest realized increase in efficiency for MBOs occurred in 1985, when operating margins grew by 14.3% in the first year following the buyout. (26)We were able to obtain a sample of reverse LBOs from an investment banking firm that wished to remain anonymous. The sample included 12 retailing firms that went public during 1985-1986. The average operating margin for the sample was 6.40%, very close to our 6.60% figure. (27)We disallowed negative interest rates by restricting the minimum prime rate to 2.0%. (28)In the interest of conserving space, we have not reported the results of our sensitivity analysis on the standard deviations of the distributions. None of the standard deviations had a qualitative impact on the probabilities. Because the floating-rate interest payments were such a small part of the total financial obligations, we also chose not to include PRIME in the sensitivity analysis. (29)The buyout was by Eckerd management and an investor group led by Merrill Lynch Capital Partners, Inc., which paid $1.2 billion in cash or $33 per share. Shareholders approved the LBO on April 30, 1986. (30)The GROWTH distribution is identical to that used for Revco. The interest rate on Eckerd's revolving credit loan of $690 million equalled either the prime rate plus 125 basis points or LIBOR plus 250 basis points. Prime at the time of the Eckerd LBO (April 1986) was about 9.0%. Thus, we assumed a base rate of 9.0% for Eckerd as opposed to the rate of 7.5% used for Revco. Detailed results of the Eckerd simulation are available upon request.

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SPECIAL FEATURES: illustration; table; graph
COMPANY NAMES: Revco D.S. Inc.--Acquisitions, mergers, divestments
INDUSTRY CODES/NAMES: BANK Banking, Finance and Accounting
DESCRIPTORS: Leveraged buyouts--Finance; Drugstores--Acquisitions, mergers, divestments
SIC CODES: 5912 Drug stores and proprietary stores
FILE SEGMENT: MC File 75

... year of the LBO (see Wruck [23, Table 2]). We take exception to Wruck's **calculations** , however, because she omits $87.5 million of principal payment due on the term loan...the buyout represent the maximum risk exposure for Revco.(17)

Cash-flow coverage ratio was **calculated** as EBIT (earnings before interest and taxes) plus proceeds from asset sales (AS) less capital...

...AS, and DEPR remain as the stochastic variables needed to compute the coverage ratios. To **calculate** EBIT, we multiplied sales by an EBIT margin defined as (2) MARGIN = EBIT/SALES. MARGIN...model has been biased downward. Thus, we have biased the survival probability upward with our **calculation** of cash flow and downward with the assumption of independence of cash flows. Although the...0.43*0.45*0.27).

Exhibit 10 is the distribution of the three-year **cash - flow** -coverage **ration** -- i.e., the probability that the sum of the cash flows for 1987-1989 is...as part of the firm's financial obligations. (17)Although not reported here, we also **calculated** an "EBIT Coverage" for each of the three years. EBIT coverage was **calculated** as earnings before interest and taxes divided by projected cash interest and principal payments on...

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4/9,K/2 (Item 2 from file: 148)
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Horizontal oil and gas wells: the engineering and economic nexus. (engineering parameters and their effect on the economics of horizontal drilling, compared to vertical drilling)

Lohrenz, John

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Horizontal oil and gas well drilling is booming while, overall, development drilling is declining. The engineering parameters and how they affect the economics of horizontal drilling, compared to vertical drilling, are examined here. As a new applied technology, horizontal drilling can promise economic advantages over vertical drilling, but with incremental risks that must be weighed carefully. In the long term, horizontal drilling will merge into the ever-growing inventory of technologies that create the economics that extend the lives of, and yield more reserves from, oil and gas fields that would otherwise decline. The result is the persisting pattern of fields yielding more production than early estimates even as it remains impossible to count which particular new technology gave rise to so much more production.

INTRODUCTION

From Euclid, petroleum engineers have learned that the most direct route from the surface to an in situ hydrocarbon-producing stratum was a vertical borehole. Continuing that vertical borehole into a producing stratum, however, limited intrusion to the thickness of the stratum. That limitation could be overcome, of course, if the borehole could turn a corner and become horizontal. In that case, intrusion of the borehole into the producing stratum would not be so limited. Results would be more hydrocarbons produced and at a faster rate. Such a dual result is precisely the definition of engineering success, as distinct from economic success, of an oil production project. It is explicit in the following proud, prototypical declamation (Moore, 1987) about a successful project:

"In the process, the company boosted oil production from 3,000 b/d to more than 28,300 b/d. Recoverable reserves climbed from 17% to more than 40% of the estimated 550 million bbl of oil in place."

Horizontal drilling seeks more reserves produced at a faster rate by unlimited lateral intrusions of boreholes into producing strata.

A concept that simple can have no single originator. Extended reach and deviated hole drilling must be antecedents of the concept. Extended-reach boreholes that fan out from offshore platforms to penetrate targets miles away have been state-of-the-art for years. Perhaps the first generation of the concept was applied by early miscreants who directed their boreholes beyond boundary lines to steal a neighbour's oil. There is a basis for the jocular boast of a modern horizontal well driller: "I'm just doing legally what my grandfather did illegally." These precursor technologies sought only to penetrate targets inaccessible to vertical holes and not to guide a borehole within a target in the manner of horizontal drilling.

The inherent problem with the concept is how to drill a borehole from the surface that turns a corner and becomes horizontal when desired. The Russians appear to be the earliest serious pioneers to exploit the concept: they drilled 43 horizontal wells in the early 1950s in an effort which was "dismissed as being uneconomical" (Lang and Jett, 1990).

Now there is a boom in horizontal drilling. For 1985, Petroleum Abstracts (1986), a comprehensive bibliography listing of all new technical publications and patents pertinent to oil and gas production, listed 44

entries on the subject. For 1989, Petroleum Abstracts (1990) listed 244 entries. That zooming technical activity paralleled actual horizontal drilling. "One or two (horizontal) wells per year are rapidly approaching 1,000 per year," observed Lang and Jett (1990) who predict that 4,000 horizontal wells will be drilled during the year 2000 in the USA and Canada. Further, the boom in horizontal drilling is countercurrent to a decline of over 60% in all wells drilled over the last five (1984-1989) years (Energy Statistics Sourcebook, 1990).

Here, we examine the intermingled engineering and economic forces which create the interest in horizontal drilling now. The next two sections summarize the engineering and economic decision parameters of horizontal drilling. Horizontal drilling is shown to be another of a continually growing aggregation of technological advances. These intermingled technical advances (helped or hurt by economic and political forces) do not make "old" producing oil and gas fields young, but continue the long-term historic pattern of fields producing more, and for a longer time, than had been estimated previously. We close with some speculations about the continuing role of horizontal drilling in that pattern.

Given a petroliferous fluid admixture in a porous media, ceteris paribus, more fluids will flow faster into a borehole of greater areal extent and with more intrusion into the porous media. That is the simple physical principle that horizontal wells exploit. The result is a faster rate of production and, ultimately, more production.

Engineers analyze well performance using a Productivity Index (PI) defined as the ratio of the volume rate of production divided by the pressure drawdown. The drawdown is the difference between the in situ driving pressure and the driving pressure in the wellbore. Ceteris paribus, a higher Productivity Index is more favourable. When considering horizontal drilling, engineers often examine the ratio of PIs of a horizontal well to a vertical well. That ratio is used as an index of engineering improvement of a horizontal well as compared to a vertical well. (We will show later that the ratio, as used, is often arbitrary.) Horizontal wells with higher PIs produce with less drawdown of pressure in situ. Less drawdown means more uniform interfaces flowing between phases. The incidence of undesirable fluids, gas and water, spearing into the borehole and becoming of the predominant producing fluid, is lessened with lower drawdowns. "Coning" is the name engineers give to the phenomenon of a well reverting to producing an undesirable fluid drawn into the borehole by pressure drawdown. Horizontal wells reduce coning.

Certain in situ conditions make horizontal wells particularly advantageous. Many petroliferous reservoirs have natural, vertical fractures. Horizontal wells with wellbores perpendicular to the fractures are, no doubt, the most widely mentioned specific application.

Oil and gas are often found in a series of dipping sands, each separated by impervious strata. That condition, too, provides an obvious horizontal well application.

The comparative advantages swing to horizontal over vertical wells as the petroliferous strata (a) are thinner, (b) are deeper in the ground, (c) are less permeable to flow, and (d) flow thicker fluids. The first advantage arises from the limited intrusion a vertical well can provide for a thin formation. The second advantage arises because the cost of reaching a deep formation is more fully exploited. The latter two advantages arise because lessening drawdown is critical when the permeability of the rock and the "flowability" of the fluids is low.

Advantages may arise at the surface, too, when horizontal drilling allows fewer wells and, offshore, fewer platforms with diminished environmental hazards.

Moore (1990) cites "special field rules regarding horizontal drilling" promulgated by the Texas Railroad Commission which insisted on 320-acre spacing for horizontal wells (for a specified horizontal length) where the vertical spacing was 80-acre. Boyd (1990) discusses the statewide

version of the special rule subsequently promulgated by the Commission which specifies minimum distances between horizontal drainholes and property lines. These new rules recognize that the advantages of horizontal drilling could evaporate with existing rules presuming vertical wells. The new rules inherently preserve correlative rights just as the old rules did. However, just as speed limits for racing autos differ from those for standard vehicles, the new rules for horizontal drilling must invoke constraints different from those for conventional vertical wells. Certainly, when and where unitization agreements are forged, including both horizontal and vertical wells, the case will be properly made that horizontal wells should be weighted heavier than vertical wells in determining the participation factors. (A reviewer has noted that horizontal drilling creates an impetus to unitize.)

One disadvantage of a field developed with horizontal drilling is a loss of operating flexibility when compared to the same field developed with a greater number of vertical wells.

Underbalanced drilling provides a unique set of advantages for horizontal wells. Underbalanced drilling means the in situ rock is impinging on the drillbit, not vice versa which is usually the case. One advantage sought with underbalanced drilling is a higher rate of penetration and, thus, less drilling costs. There is another possible advantage. The direction of fluid flow during underbalanced drilling is from the formation into the borehole instead of into the formation from the borehole. This eliminates formation damage caused when drilling fluid solids plug the porous media at the walls of the borehole. Formation damage lowers PIs. Further, since one is drilling through productive formation making the horizontal drainhole, and flow is from the formation to the drainhole, substantial quantities of oil can actually be produced during underbalanced horizontal drilling: one operator claims oil produced during drilling paid off half of a well (Moritas, 1990). That is a substantial advantage. There is a downside to this largesse, however, plainly evident in the following two quotations about underbalanced drilling:

"Obviously, with this type of drilling, safety is of critical concern - something Oryx says it can't stress enough. During the horizontal hole section, Oryx has company men on 24-hour supervision of the rig site. Safety meetings are frequent and mandatory" (Moore, 1990).

"To date, no major problems have occurred, although any time hydrocarbons are around the drill floor there is a reason to exercise utmost caution" (Moritas, 1990).

Clearly, the benefits of underbalanced drilling are accompanied by a higher hazard of the occurrence of the one event every driller guards against most avidly: the well blowout and conflagration that may, as a result, ensue.

Underbalanced drilling is not the only source of additional risk that horizontal drilling adds. Horizontal drilling is possible today primarily because of the confluence of three new technical capabilities. Three-dimensional dense seismic technology locates the petroliferous targets, e.g. fractures, which the borehole should penetrate. Downhole measurement-while-drilling (MWD) tools provide essentially real time information of what the drill bit is penetrating. Steerable motor assemblies (SMAs) react in essentially real time to the MWD signals and allow course adjustments to keep on target. All this impressive high technology is subject to the foibles of people, and to the forces lurking in situ which are never all known. Expensive SMAs and MWD tools can be lost. Operators must either have insurance or pay up.

In spite of all the high technology, horizontal drilling is especially prone to provide wholly unanticipated surprises. De Montigny et al. (1988) provided the following candid list of surprises which they encountered in their projects:

"Planned horizontal length was 1,400 ft, but the hole left the reservoir after only 820 ft."

"... two wells unexpectedly encountered fissures in the shape of large fractured corridors. These had never been intersected in spite of the many vertical wells already drilled."

"... two surprises ...: (1) ... fracturing was not at all as expected ... ... fracturing directions observed did not correspond to those seen in the earlier vertical wells ... (2) ... two minigrabens ... invisible on the seismic lines" ... had to be plugged lowering the productivity.

and summarizing:

"In each case, the drainhole encountered features which were quite unpredictable ...."

Petzet (1990) recounts a real puzzler:

"Another well penetrated three vertical fractures. One contained a tar-like, almost dead ... oil; the next a lighter, green oil; the third a black oil with a small amount of sulfur."

Every driller remains in awe of the surprises that, in spite of all planning and foresight, can arise. Horizontal drilling brings another dimension of surprises to confound drillers. "There are just a lot more things you don't know that can go wrong," observed one driller about horizontal drilling. Here, we shall observe that horizontal drilling has inherent incremental risks and uncertainties when compared to vertical drilling, but the driller said the same thing better.

THE ECONOMIC PARAMETERS

Conventional vertical of horizontal drilling? That is the key economic decision. Horizontal drilling, as defined here, is a purposeful intrusion of the borehole into producing strata in a horizontal, or nearly horizontal, direction. Conventionally, horizontal drilling starts with a vertical borehole, the most direct route to the target strata, and then "turns a corner." However, not infrequently, at the surface the borehole will not start on the vertical axis. A slant hole will start at the surface, for example, in order to reach target-producing strata inaccessible with a vertical start. A non-vertical slant hole at the surface may, or may not, be horizontal drilling. When the slant hole purpose is simply to penetrate strata, that is not a horizontal well as defined here. Only when the intent of the borehole, having reached the producing strata with a vertical or non-vertical trajectory from the surface, is to then intrude horizontally do we here imply genuine horizontal drilling.

A horizontal well costs more and has a different array of risks than a vertical well, but can be justified by yielding greater after-drilling cost values by producing at a faster rate and/or, ultimately, more. The following nomenclature is introduced to capture the vertical vs. horizontal drilling decision:

[C.sub.h] and [C.sup.v] = cost of drilling a horizontal and vertical well, respectively;

[V.sub.h] and [V.sup.v] = net present value from production operations on a horizontal and vertical well, respectively;

[W.sub.h] and [W.sup.v] = expected net present value of drilling and completing a horizontal and vertical well, respectively;

[r.sub.h] = incremental risk of failure of a horizontal well vis-a-vis a vertical well, fraction;

a = fraction of additional horizontal well cost, [C.sup.h], if horizontal well is a failure.

Define:

[F.sub.h/v] = [C.sub.h]/[C.sub.v] [R.sub.h/v] = [V.sub.h]/[V.sub.v] I = [V.sub.v]/[C.sub.v]

Note that I is an index of the economic "goodness" of the vertical well used for comparison. The expected net present values, [W.sub.h] and [W.sub.v], are: [W.sub.v] = [V.sub.v] - [C.sub.v] [W.sub.h] = [(1.r.sub.h.)][R.sub.h/v.V.sub.v] - [F.sub.h/v][C.sub.v][1+ar.sub.h.)].

What is [r.sub.h]? Murray (1989) found that about 21.1% of all U.S. and 15.0% of all Canadian development wells were failures; Murray's finding

is the latest of a series of annual surveys which approximate the 1989 outcomes. Those statistics are, however, for all development wells, not just horizontal development wells. Horizontal wells do have greater inherent operational risks, but, on the other hand, tend to be sited more where superior geological and engineering information has been gathered, which should lessen the risk. Further, horizontal wells can sometimes offer multiple opportunities for success (or chances to avoid failure) which a vertical well in the same location cannot. For example, if the first anticipated fracture does not appear, continuing the horizontal borehole to the next anticipated fracture can more than redeem the first failure. Some operators design horizontal boreholes with a very wide-angle V in the producing stratum so that the end of the hole may be perilously close to penetrating a "seal." That seal, is broken (and it may be), will allow entry of undesirable water or gas. The same seal, if not broken, will allow superior recovery. The practical strategy behind the wide-angle V horizontal borehole is that, if the seal is broken, the operator can blank off the borehole near the broken seal and produce from the good leg of the V. All is not lost when the gamble to test the seal is lost.

The additional cost of failure captured with the parameter, a, may be either negative or positive. Petzet (1990) costs out a horizontal well with about 40% completion costs. If that were the only consideration, that would imply a = -.4, as completion costs are avoided with failure of a horizontal well. When high-technology hardware are stranded downhole or destroyed, or other costs coincident with failure must be considered, a is positive.

In summary, both [r.sub.h] and a are parameters that, though based on all pertinent data and experience, remain subjective estimates specific to each horizontal well. Here, we consider [r.sub.h] over the range 0 to 0.4, and -0.4<a<0.4.

Consider expected net present value as the economic decision criterion. Then proceeding with a horizontal well and not a comparable vertical well is justified if [W.sub.h]>[W.sub.v] and [W.sub.h]>0. We have:

Minimum [R.sub.h/v]/[F.sub.h/v]
([W.sub.h]>[W.sub.v] = (I+[ar.sub.h])/[I(1-[r.sub.h])] (1)

Minimum [R.sub.h/v]/[F.sub.h/v]
([W.sub.h]>0) = (1 + a)/[I(1-[r.sub.h])] (2)

and

I
[R.sub.h/v]/[F.sub.h/v]
([W.sub.h] = [W.sub.v])] = [[R.sub.h/v/[F.sub.h/v]
([W.sub.h] = 0)] = 1 + a (1 + [r.sub.h). (3)

Figure 1 shows the minimum [R.sub.h/v]/[F.sub.h/v] that justifies horizontal drilling as a function of I when a =) with [r.sub.h] of 0, 0.2, and 0.4. When I<1, the vertical well used for comparison would not be justified, but if a horizontal well has an [R.sub.h/v]/[F.sub.h/v] greater than the minimum, horizontal drilling can be justified where vertical drilling cannot. When [r.sub.h] = 0 and I>1, any [R.sub.h/v]/[F.sub.h/v]>1 indicates horizontal drilling is more attractive economically than an already economic vertical well. Figure 1 shows how increasing [r.sub.h] (when a = 0) makes justification of a horizontal well more difficult.

Figure 2 shows minimum [R.sub.h/v]/[F.sub.h/v]s versus I when [r.sub.h] = 0.2 with a = -0.4, o, and 0.4. A higher a also makes justification of a horizontal well more difficult. Note that all three curves on figures 1 and 2 have a discontinuity defined by equation (3).

De Montigny and Combe (1988) mention the fact that their horizontal drilling project replaces two vertical wells while costing only about 1.3 times more. Thus, they had [R.sub.h/v] = 2, if present value from production operations is imputed to their assessment, and [F.sub.h/v] = 1.3 with [R.sub.h/v]/[F.sub.h/v] = 1.54. Since the project is proceeding, this [R.sub.h/v]/[F.sub.h/v] must have been above minimum Figures 1 and 2 show the values of [r.sub.h] and a which would have made the project uneconomic. Note that when [r.sub.h] and a = 0, this project's horizontal well with I =

0.65 could still be justified. From I = 0.65 to 1, the comparable vertical well would not be economic, yet horizontal drilling could proceed economically and create new recoverable reserves where vertical drilling would create none.

Comparable Horizontal and Vertical Wells

What constitutes a fair comparison between drilling a horizontal or vertical well in any specific project? The theoretically viable answer would be that each contending well design, horizontal and vertical, is fully optimized. However, given the in situ uncertainties and history of surprises previously mentioned, optimization can only be implemented implicitly using an accumulation of past experiences and data in the area, if at all. Generally, a field has been discovered and drilled with vertical drilling. In the process, a more-or-less "standard-to-that-field" vertical well design has evolved at the time horizontal well drilling is considered. The usual comparison is between alternate horizontal well designs and the locally standard vertical well design.

If optimal horizontal and vertical well designs are considered, then the optimal decline rates for the wells should differ. For exponential decline, assuming negligible fixed operating costs, Lohrenz et al. (1981) showed:

[D.sup.*] = [square root] i/[N.sub.D] - i (4) where,

[D.sup.*] = exponential decline rate that maximizes the net present value of development and subsequent production, [year.sup.-1];

i = discount factor, [year.sup.-1];

[N.sub.D] = after-tax development cost divided by initial after-tax net cash flow from production operations, years.

(Subsequently, equation (9) presents a mathematical definition of [N.sub.D].) Adelman (1990) shows precisely the same relationship between [D.sup.*] and development costs using a parameter other than [N.sub.D]. Horizontal drilling is only advantageous if its [N.sub.D] is lower than the [N.sub.D] for vertical drilling; therefore, the optimal rate of decline, [D.sup.*], should be higher for an optimized horizontal well as compared to its optimized vertical counterpart.

Contrary to the above effect if well designs are optimized, Kuich (1990) observes, "Production histories today indicate a similar decline curve for horizontal and vertical wells." Sheikholeslami et al. (1989) show actual production data for eight comparable horizontal and vertical wells that agree with her observation. The implication is that non-optimal horizontal and vertical wells are being compared.

From the economic viewpoint, this means that the comparisons are likely to be arbitrary and depend on the particular vertical well designs selected as the standard for comparison. It can mean that gains in reserves and values attributed to horizontal as compared to vertical drilling are arbitrary.

There may be exceptions to the practice of comparing non-optimal horizontal and vertical wells. For example, a horizontal well costing $1.7 million and a vertical well costing $0.873 million are compared (Oil & Gas Journal, 1989). Here, [R.sub.h/v]/[F.sub.h/v] = 1.364 and D = 0.18 and 0.45 for the vertical and horizontal well, respectively. Using the specific discount factor, i = 0.1, equation (4) would indicate [N.sub.D] = 0.755 and 0.331 for the vertical and horizontal wells, respectively, if optimized. Given a tax regime applicable to both types of wells, the lower [N.sub.D] indicates the true economic benefit of applying the technology of horizontal drilling in this case, provided the vertical well considered, too, was an optimal design.

In summary, when no vertical well can be justified, i.e. I<1, then any horizontal well that can, nevertheless, still be justified in the proposed project creates new reserves and values. Where horizontal drilling only enhances the economics of an already economic vertical drilling project, i.e. I>1, reserves and values are added. The quantities of new reserves and additions may be misleading unless both well designs were

optimal.

Production Rate Uncertainty

Table 1 shows initial well production rate data [q.sub.o], from three horizontal drilling programs exploiting naturally fractured reservoirs. Clearly, horizontal drilling entails an uncertain outcome with regard to [q.sub.o] and, therefore, an uncertain economic outcome as well. A reasonable first approximation is that [q.sub.o] is exponentially distributed. The supporting rationale premises that the number of fractures encountered has a Poisson distribution and that each fracture contributes an equal quantity of production. The exponential distribution is the continuous analog of the Poisson distribution. With the exponential distribution,

ln F([q.sub.o]) = [-q.sub.o]/E([q.sub.o])

where,

E([q.sub.o]) = arithmetic mean initial production rate, barrels per day; F([q.sub.o]) = frequency of a rate greater than [q.sub.o], fraction.

Figure 3 shows ln F([q.sub.o]) versus [-q.sub.o]/E([q.sub.o]) for the data of Table 1. Without resorting to statistical tests, we conclude that the agreement is sufficiently satisfying to validate the use of the exponential distribution to characterize uncertainty of [q.sub.o].

Uncertaintly of Present Value from Production Operations

Assuming an exponential decline, D ([year.sup.-1]), with production continuing through time, t, of infinity and no production-independent operating costs, the present value of production operations, V, is:

[TABULAR DATA OMITTED]

[Mathematical expressions omitted]

where,

p = price of a barrel of oil, $ per barrel; f = fraction of gross operating revenue net to operator; [X.sub.R] = factor converting before-tax operating revenue to after-tax.

With the subscripts, h and v, having their obvious implication, we have:

[R.sub.h / v] = [V.sub.h] / [V.sub.v] = [q.sub.o,h] ([D.sub.v]+i) / [q.sub.o,v] ([D.sub.h]+i) (7)

Thus, if [D.sub.h] = [D.sub.v], the present values of production operations are proportional to the initial production rate and [R.sub.h/v] is equal to the ration, [q.sub.o,h] to [q.sub.o,v], under the stated assumptions.

An example **calculation** based on the comparison of horizontal and vertical wells already cited with [F.sub.h/v]=$1.7/$9.873=2.05 (Oil & Gas Journal, 1989) shows how uncertainty with regard to [q.sub.o,h] can induce substantial economic risk. The source indicates one can presume that vertical wells, which expect to intrude only non-fractured reservoir rock, have a predictable [q.sub.o,v]=88.7 barrels of oil (equivalent) per day; E[q.sub.o,h]=432 barrels of oil (equivalent) per day with [D.sub.h]=0.45 and [D.sub.v]=0.18. Horizontal drilling can have an advantage over vertical drilling only if [R.sub.h/v]>[F.sub.h/v] is the minimum 2.05 ([q.sub.o]=357 barrels per day), equation (5) shows that 56% of the time the horizontal well may be expected to yield an economic outcome less favourable than the comparable vertical well. In fact, [q.sub.o] will exceed E([q.sub.o]) only 37% of the time. Clearly, even though this example has an expectation favouring horizontal, rather than vertical, drilling, substantial economic risk is added. A large portion of the favourable economics arise from those few horizontal wells which yield the highest production rates.

OIL AND GAS DEVELOPMENT ECONOMICS

Consider a generic investment of amount, [C.sub.D][X.sub.D][pq.sub.o], where,

[C.sub.D] = development cost per dollar of initial gross revenue, year;

[X.sub.D] = factor converting before-tax development cost to after-tax.

That investment incurred at time, t=0, initiates production at rate, [q.sub.o], which declines exponentially at rate, D, through infinite time. Assume production-independent fixed operating costs are negligible. The present value of the development project, [V.sub.D], (which differs from the present value of production operations, V, after development) is:

[V.sub.D] / (Qf[X.sub.R]p) = [-N.sub.D]D+D / (D+i) (8)

in which the fact that the cumulative production through infinite time, Q = [q.sub.o] / D, is used and the mathematical definition of [N.sub.D] emerges as:

[N.sub.D] = [C.sub.D][X.sub.D] / [fX.sub.R] = [C.sub.D][X.sub.D] / (1-r-[c.sub.o])[X.sub.R] (9)

have been used. In equation (9), r is the royalty rate as a fraction of the gross value of production and [c.sub.o] is the fraction of gross value of production that is production-dependent operating costs. Note that the numerator of equation (9) is the tax-adjusted development cost per dollar per year of gross revenue from production when time, t = 0, and the denominator is the tax-adjusted fraction of net revenue per dollar of gross revenue. [N.sub.D], thus, has the units of time. [N.sub.D] is an index of development difficulty; lowering [N.sub.D] implies overcoming development difficulties.

Note that the left side of equation (8) is the **ration** of the present value to the undiscounted net **cash flow** . Differentiating equation (8) with respect to D and solving for the maximum [V.sub.D] with D leads to equation (4) already mentioned. Equation (8) shows the pivoltal role of [N.sub.D] in all oil and gas development projects, whether or not optimized. The lower [N.sub.D], the more favourable the economics of a development project. In a very real sense, the effort of every high-technology initiative (as well as every oil and gas lobby) is the lower [N.sub.D]. Earlier, an [N.sub.D] for a horizontal well less than that of the comparable well was imputed. But that is only a specific success story of a lower [N.sub.D].

AN EXAMPLE OF ENGINEERING AND ECONOMICS AT "WORK"

Consider the Monroe gas field discovered in 1916. The field which peaked at 630 million standard cubic feet per day in 1944 has accumulated production of about 7.3 trillion cubic feet by 1990 and is still producing 80 million cubic feet per day. Figure 4 shows the production history of this field.

After peak production, decline has been general. A straightline on Figure 4 describes a period of uninterrrupted exponential decline. A straightline drawn through production from 1944 through 1990 would indicate a decline: D = 0.043. Yet the production data in detail show three distinct, interrupted declines during those years. Betweeen 1944 and 1960, a decline, D = 0.066, which was arrested, is displayed. Between 1965 and 1978, another decline, D = 0.059, which was also arrested, is displayed. Between 1981 and 1990, another decline, D = 0.048, is displayed; it is continuing. Each later decline was slower than the preceeding one.

What were the reasons for the two arrested declines? The thesis here is that the opportunity to exploit lower [N.sub.D]s supplied the reasons. The advent of engineered artificial fracturing in the field during the early 1960s seems clearly to have been the cause of the lower [N.Sub.D]s that led to the first arrested decline. For the second arrested decline, [N.sub.D]s were lowered by the 1978 legislation that allowed certain higher market gas prices. More intensive drilling followed, yielding a production surge.

Will the current production decline also be arrested? We cannot say, but management is even now pursuing a horizontal drilling project. To be sure, this is not a deep or low permeability field that provides particular technical leverage to horizontal wells. Yet, even here, horizontal drilling is not unreasonable. What is always reasonable is exploiting a lower [N.sub.D] when available without concern about its technical, economic or political provenance.

A 1918-1919 driller's log of a Monroe gas well describes a well which took almost nine months to drill in the shallow (2,000 + feet) field. No cost data were found; however, it is certain that the real cost of that well was far more than the wells being drilled today for $50,000 as part of an active program. These modern wells are drilled in a day and, after letting the cement harden for two days, are completed and start producing gas and cash flow. Once can presume the 70+ years of the Monroe gas field has benefited from consdierable [N.sub.D] shrinkings over the years.

In 1921, the official estimate (Bell and Cattell, 1921) of Monroe field ultimate recoverable reserves was 4.75 trillion cubic feet. Four years later, the official estimate (Bell, 1925) was lowered to 3.77 trillion cubic feet after one-sixth of that amount had already been produced. Concurrent with that 1925 prognostication, various rate-time projections were made. The longest possible life of the field called for its demise in 1965.

That the Monroe field has overturned those predictions by having already produced 7.3 trillion cubic feet while still being in production and also undergoing more intensive development even as gas prices hover near a historic bottom is interesting, not because of its uniqueness, but because this is commonplace for oil and gas projects. Oil and gas fields that continue producing and produce far more and for longer periods of time than had previously been predicted are common. In fact, the literature is replete with studies correlating the patterns of "growth" of perceived oil and gas reserves as a field is produced (Arrington, 1960; Davis, 1979; Marsh, 1971 and Pelto, 1973). These correlations indicate that a barrel of newly discovered oil ends up, in time, to be around ten barrels, and of one cubic feet of gas, about six cubit feet. Adelman (1990), also notes this pattern and how theory and predictions are confounded by the pattern.

These are substantial growths in production which may be attributed to a myriad of causes including horizontal drilling, but the root cause is a lower [N.sub.D].

Lowering [N.sub.D]

Examination of equation (9) delineates the routes to lower [N.sub.D]s. One route is to lower [X.sub.D] / [X.sub.R]. That implies lower effective tax rates to development expenses as compared to production revenues. That is why oil and gas lobbyists are fond of tax credits on drilling costs, for one thing. Another route would be a lower royalty rate, r, but that remedy is normally prohibited by contractual terms. Both of those routes are nontechnical, however.

A technical route is lowering [C.sub.D], the development cost per rate of gross operating revenue. Another technical route, of more limited impact, is to lower [c.sub.o]. the production-dependent operating cost. In fact, the entire business of drilling engineering -- whether research in sophisticated laboratories, developmental efforts in selected locations, or simple day-to-day (and night) attention to detail on a drilling rig -- can be said to focus solely on burnishing, if not chopping, [C.sub.D]s. Years ago, rotary drilling largely supplanted cable drilling by allowing a lower [C.sub.D]. Today, new offshore platform designs with lower [C.sub.D]s supplant older designs. Countless technologies have appeared through the years which, either abetted or burdened by economic and policy forces affecting [X.sub.D] / [X.sub.R], lower [C.sub.D] and, therefore, [N.sub.D]. The result is more production than previously expected from producing wells and wells drilled which previously would not have been drilled. Thus, the pattern of growth in perceived oil and gas reserves with time rose, continued, and, today, continues.

Horizontal drilling and all its supporting high-technology capabilities lower [C.sub.D]s: if they did not they would never get used in state-of-the-art applications. An estimate of additional reserves created by horizontal drilling would be an imaginary number without check sums. The reason is that one cannot conduct a controlled test isolating the gains from any particular new technology. Yet, it is clear that horizontal

drilling is certainly now on the long roster of technologies that create the pattern of reserve growth in time from producing fields.

THE FUTURE OF HORIZONTAL DRILLING

The errant doomsayers for the Monroe gas field were not professionally derelict; no doubt they made their pronouncements based on the best information then available. That was, and is, precisely the problem with even the most sophisticated and abundantly expert-supported prediction.

Is horizontal drilling a passing comet attracting great interest which will soon merge into the cosmos or will it be the basis for a revolution in oil and gas production that will alter the current supply infrastructure? Aware of the hazard of attempting predictions, we argue here that the former is the better conjecture even as we marvel at the brilliant and swift exploitation of horizontal drilling.

One must keep in mind that horizontal drilling does not produce any hydrocarbons that could not physically be produced by more intensive vertical drilling. Horizontal drilling, when justified, wields an economic advantage and serves as a superior scheme of infill vertical drilling. Further, even if the prediction of 4,000 horizontal wells drilled per year in 2000 in the USA and Canada comes true, and it may, that is only about 10% of the wells drilled in 1989 (Energy Statistics Sourcebook), 1990). That does not imply overturn of the current supply picture for oil and gas.

On the other hand, consider enhanced oil recovery (EOR) technologies which have been intensivly researched, developed, and applied over the last four decades. McGannon (1990) recently noted that EOR contributes only 9% of total U.S. crude production, and 70% of the EOR production is steam injection. This means that all of the EOR efforts for carbon dioxide, nitrogen, flue, and hydrocarbon injection, plus chemical and polymer flooding, have, to date, led to a contribution of only 2.7% of U.S. current production. Compared to that bleak outcome, horizontal drilling is a whirlwind technical success. EOR technologies would, if successful, lead to access to hydrocarbon reserves otherwise not producible, but so far the results have been rather thin gruel.

That is why we conclude that horizontal drilling will be, in time, a contributing technology to reserve growth, but only one of many. Other historic contributors are well-logging, mud technology, reservoir mathematics, etc. Each is a substantial contributor, but no experiment can be concocted to isolate any particular technology's quantitative contribution of reserves or values.

If I restrict myself to one caveat attached to the assessment, it is this: it is at least a possibility that extension of gadgets and technologies that now serve horizontal drilling will ead to a low-cost capability to seek new sources of oil and gas without creating a conventional borehole, only an expendable one. If that becomes a reality, the orders-of-magnitude lower exploration costs that would result could drastically revise where the perceived inventories of in situ oil and gas large enough to be major factors or even predominate in worldwide markets are, and who owns them. If and when that happens, however, one suspects that horizontal drilling will be recalled as one of many stepping stones on the way.

(*) If Dr. G. Campbell Watkins had not suggested this topic to me, this paper would certainly never have been initiated. His continuing suggestions and encouragements, plus those of Dr. Morris A. Adelman, catalyzed my activities so that while I am responsible for any errors, they share substantial responsibility for the fact that this paper was written at all.

(**) Department of Petroleum Engineering and Geosciences, Louisiana Tech University, P.O. Box 10348, Ruston, LA, 71272-0046

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CAPTIONS: Minimum criteria for horizontal wells as a function of incremental risk. (graph); Min. criteria for wells with changes in well costs conditional on failure. (graph); Distribution of initial production rates of horizontal wells. (table); Distribution probability plot of hor. well original production rates. (graph); Production history of the Monroe gas field. (graph)

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 SPECIAL FEATURES:  illustration; graph; table
 INDUSTRY CODES/NAMES:  OIL   Petroleum, Energy Resources and Mining
 DESCRIPTORS:  Gas well drilling--Innovations; Intangible drilling and
  development costs--Analysis; Engineering economy--Research; Directional
  drilling--Analysis; Oil well drilling--Innovations; Petroleum engineering
  --Research
 SIC CODES:  1311  Crude petroleum and natural gas; 1381  Drilling oil and
  gas wells
 FILE SEGMENT:  TI File 148

...     q.sub.o,h] to [q.sub.o,v], under the stated assumptions.
      An example  calculation  based on the comparison of horizontal and
vertical wells already cited with [F.sub.h...D] implies overcoming
development difficulties.
      Note that the left side of equation (8) is the  ration  of the
present value to the undiscounted net  cash   flow . Differentiating
equation (8) with respect to D and solving for the maximum [V.sub.D...
? ds

Set     Items   Description
S1     149434   INVESTMENT (2N) PORTFOLIO
S2         41   CASH (4N) FLOW (4N) RATION
S3          3   S2 AND CALCULAT?
S4          3   RD S3 (unique items)
? s CASH (3N) FLOW (3N) RATIO
         4892912  CASH
         3109821  FLOW
         1740021  RATIO
      S5    8897  CASH (3N) FLOW (3N) RATIO
? s s1 and s5
          149434  S1
            8897  S5
      S6     179  S1 AND S5
? s s6 and py<1999
Processing
Processed  10 of  25 files ...
Processing
Processed  20 of  25 files ...
Completed processing all files
             179  S6
        58730712  PY<1999
      S7      57  S6 AND PY<1999
? rd s7
...examined 50 records  (50)
...completed examining records
      S8      48  RD S7 (unique items)
? ds

Set     Items   Description
S1     149434   INVESTMENT (2N) PORTFOLIO
S2         41   CASH (4N) FLOW (4N) RATION
S3          3   S2 AND CALCULAT?
S4          3   RD S3 (unique items)
S5       8897   CASH (3N) FLOW (3N) RATIO
S6        179   S1 AND S5
S7         57   S6 AND PY<1999
S8         48   RD S7 (unique items)
? s s8 and rank?
             48  S8
        2309496  RANK?
      S9      17  S8 AND RANK?
```

? t s9/3,k/all

9/3,K/1 (Item 1 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)

01253922 99-03318
U.S. Re: Finding firm ground in A soft market
Elkind, Craig K; Levin, Alan M
National Underwriter (Property & Casualty/Risk & Benefits Management) v100n29 PP: S6-S13 Jul 15, 1996
ISSN: 1042-6841 JRNL CODE: NUN
WORD COUNT: 5787

...TEXT: been quite useful for many participants in the marketplace to identify companies and their relative **ranking** within the industry. We hope that this improved **ranking** , based on the security rating Standard & Poor's provides for each of these reinsurers, will... instruments to ascertain inherent prepayment/extension risk in large interest rate swing scenarios.

The collective **investment portfolio** of active reinsurers is comprised of 57.9 percent bonds, 29.4 percent common stock...

... In terms of credit quality, over 99 percent of the reinsurance industry's fixed income **portfolio** was rated **investment** grade by Standard & Poor's.
The traditional ... 126.5 percent for 1995 versus 117.9 percent in the prior year. The total **cash flow ratio** , which includes the effects of investing and financing decisions, stood at 143.3 percent for...

...DESCRIPTORS: Ratings & **rankings**

9/3,K/2 (Item 2 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)

01132767 97-82161
Exchange risk sensitivity and its determinants: A firm and industry analysis of US multinationals
Choi, Jongmoo Jay; Prasad, Anita Mehra
Financial Management v24n3 PP: 77-88 Autumn 1995
ISSN: 0046-3892 JRNL CODE: FMG
WORD COUNT: 5878

...TEXT: provides a better understanding of the distribution of these coefficient values. The 61 coefficients are **ranked** in descending order and grouped into quartiles. The first quartile, which includes the firms with... For example, a firm with $200 million in total sales and a 20% foreign sales **ratio** will have a larger **cash flow** exposed to exchange rate risk than a firm with $100 million in total sales and...that exchange exposure patterns may be examined by using other classification schemes, such as capitalization- **ranked** portfolios or the export- or import-orientation of firms. However, given our focus on examining...
Multinational Transactions," Financial Management (Autumn), 23-29.

Elton, E.J. and M. Gruber, 1991, Modern **Portfolio** Theory and **Investment** Analysis, 4th ed., New York, NY, John Wiley.
Errunza, V.R. and L.W. Senbet...

9/3,K/3 (Item 3 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)

01063859 97-13253
U.S. re market shaken but not stirred, Standard & Poor's says
Elkind, Craig; Walsh, Thomas
National Underwriter (Property & Casualty/Risk & Benefits Management) v99n29 PP: S6-S12 Jul 17, 1995
ISSN: 1042-6841 JRNL CODE: NUN
WORD COUNT: 3945

...TEXT: U.S. reinsurance market illustrates the tiered structure of capital strength among competing firms. As **ranked** by policyholders' surplus, the top-tier of reinsurers (number one to number six) continues to ... collateralized mortgage obligations, mainly consisting of agency pass-throughs in more senior tranches.

The collective **investment portfolio** of active reinsurers is comprised of 62 percent bonds, 26 percent common stock, 3 percent...

... the issue of credit quality, over 99 percent of the reinsurance industry's fixed-income **portfolio** was rated **investment** grade as categorized by the National Association of Insurance Commissioners. Reinsurers' assumption of substantial risks...
...the trends in non catastrophe insurance rates exhibit little change.

Among active reinsurers, the underwriting **cash flow ratio** --which is roughly earned premium inflow divided by loss and expense outflow--rose to 118 percent for 1994 versus 114 percent in the prior year. Although sources of underwriting **cash flow** still exceed uses, this **ratio** is far below the 140 percent range of the late 1980s.

Resurgent premium growth has...

... years, thus allowing for cash flow growth since 1992's 101 percent figure. The total **cash flow ratio** , which includes the effects of investment and finance decisions, stood at 1 36 percent for...

...DESCRIPTORS: Ratings & **rankings** ;

9/3,K/4 (Item 4 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)

00873374 95-22766
Catastrophes bedevil US reinsurers
Walsh, Thomas C; Gangemi, Mary Anne
National Underwriter (Property/Casualty/Employee Benefits) v98n24 PP: SS6-SS7+ Jun 13, 1994
ISSN: 0898-8897 JRNL CODE: NUN
WORD COUNT: 1975

...TEXT: highlights the difference in financial strength between the various tiers of the reinsurance market.

As **ranked** by policyholder surplus, top-tier (**ranked** 1-10) reinsurers

continue to report stronger financial results, market-share increases, greater capital strength and more adequate loss reserves compared with their second (**ranked** 11-20), third (**ranked** 21-35) and bottom-tier (**ranked** 36-64) competitors.

For the purposes of this analysis, S&P has focused on 64...

...Indemnity.)
The credit quality of the bond portfolio is excellent, with 99 percent of the **portfolio** rated **investment** grade as categorized by he National Association of Insurance Commissioners

S&P expects no change...REBOUNDS:

Hardening property-catastrophe rates and declining catastrophe losses resulted in improved underwriting and total **cash** - **flow** ratios in 1993.

The underwriting **cash** - **flow** **ratio** for the active reinsurance industry was 114.1 percent in 1993, a 13.2 percentage...

...constrain cash flow in the 1990s.

In 1993, top-tier reinsurers recorded a healthy underwriting **cash** - **flow** **ratio** of 124.4 percent--well above the remaining tiers, none of which recorded a ratio...

...DESCRIPTORS: Ratings & **rankings** ;

9/3,K/5 (Item 5 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)

00808426 94-57818
Kohlberg Kravis Roberts & Co. and the restructuring of American capitalism
Kaufman, Allen; Englander, Ernest J
Business History Review v67n1 PP: 52-97 Spring 1993
ISSN: 0007-6805 JRNL CODE: BHR
WORD COUNT: 18701

...TEXT: reassert financial control over the firm. To prevent mutual funds from seeking control of their **portfolio** investments, the **Investment** Company Act of 1940 unfavorably taxed mutual funds with concentrated holdings to ensure managerial autonomy...Lehman Hutton had all entered the market, and Salomon Brothers was poised to join their **ranks** . These competitors arrived at an unpropitious moment for KKR; its Beatrice buyout--the deal that...in research and development.

The most vocal opponents of this sanguine appraisal came from the **ranks** of corporate managers. In contrast to financial agency theorists and investment bankers, managers declared that...8-9.

81 Stein and Kaplan depict the period in the following way: 1) the **ratio** of buyout price to company **cash** **flow** moved upward in the latter part of the 1980s; 2) buyout premiums also rose, nearly...

9/3,K/6 (Item 6 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)

00734474 93-83695
Record catastrophe losses stagger reinsurers
Walsh, Thomas C; Gangemi, Mary Anne
National Underwriter (Property/Casualty/Employee Benefits) v97n27 PP: SS3-SS10 Jul 5, 1993
ISSN: 0898-8897 JRNL CODE: NUN
WORD COUNT: 3625

...TEXT: when the industry's combined ratio reached a high of 130.9 percent. Indeed, 1992 **ranks** as the third-worst underwriting year on record for the reinsurance industry as a whole...

... catastrophe segment of the reinsurance industry has opened windows of opportunity for first (top 10 **ranked** by net premiums written), second (**ranked** 11-20) and third (**ranked** 21-35) tier players, who seek to benefit from more favorable property catastrophe rates.

Well... impacted the underwriting results of the U.S. reinsurance industry. Driven by Hurricane Andrew, 1992 **ranks** as the third worst underwriting year for professional reinsurers in the last 32 years.
While...

...and third tier reinsurers, recording a combined ratio of 114 percent, as compared to reinsurers **ranked** 11 through 20 (122.6 percent) and 21 through 35 (125.2 percent).

The differentiation...

... percent for the top 10 active companies, compared to 91.2 percent for those companies **ranked** 11 through 20, and 96 percent for those **ranked** 21 through 35.

Although reinsurers falling within these categories differ in terms of risk profile...

... not exposed to the asset-quality issues which have plagued the life insurance industry. The **investment portfolio** of the 71 active professional reinsurers remains conservative. The industry invests primarily in fixed income...

... the National Association of Insurance Commissioners. Common equity holdings made up 13 percent of the **investment portfolio** at $5.9 billion, with cash and short-term investments making up the bulk of...and record catastrophe loss payments, coupled with intense competition for market share, have ground underwriting **cash flow** to a halt.

The underwriting **cash flow ratio** has trended downward over the last three years to an eight year low of 100...

...year ended Dec. 31, 1992.

This ratio is significantly lower than in 1986, when the **cash flow ratio** for active U.S. professional reinsurers reached 146 percent. On a total cash flow basis...

...of active U.S. reinsurers recorded negative operating income in 1992.

Notably, bottom tier companies (**ranked** 36 to 71) reported a return on revenue significantly above the second and third tier...

...surplus was 2.14-times for the top 10 reinsurers, 1.99-times for those **ranked** 11 through 20 (second tier companies), 1.88-times for those **ranked** 21 through 35 (third tier companies), and only .86-times for the remaining 36 industry...

...DESCRIPTORS: Ratings & **rankings** ;

9/3,K/7 (Item 1 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)
(c) 2004 The Gale Group. All rts. reserv.

01207888 SUPPLIER NUMBER: 06167870 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Lotus-compatible software products. (Listings)
Koerner, Katherine
Lotus, v3, n12, p143(19)
Dec, 1987
ISSN: 8756-7334 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT
WORD COUNT: 21738 LINE COUNT: 01817

... add others. Performs analysis by detailed system elements, lists characteristics in order of priority, and **ranks** each system. Includes companion guide. Worksheet application for 1-2-3 Releases 1A or 2...Center, Rolling Meadows, IL 60008, 800-323-8552. Analysis module performs percent-and-dollar-change, **cash - flow** , **ratio** , and pro forma analyses. Database module maintains data used in Analysis module and allows the...of the budget to multiple accounts. Determines the impact of variables on defined objectives and **ranks** variables by impact level. Performs simultaneous Monte Carlo simulation with as many as 20 variables... significant factors influencing a decision. Decisions are based on weights allocated to criteria and the **rankings** assigned to each decision item or option. Worksheet application for 1-2-3 Releases 1A...CA 90278, 213-379-1205. Provides three integrated decision-support models: Evaluate helps quantify and **rank** decision options, providing reasons for rejected options; Select helps select the optimal set of activities...

...7300. Linear programming capabilities automatically produce optimal solutions for staff scheduling; product mix; resource planning; **investment - portfolio** selection; management of assets, liabilities, projects, and inventory; and

19871200

9/3,K/8 (Item 1 from file: 16)
DIALOG(R)File 16:Gale Group PROMT(R)
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03926134 Supplier Number: 45672805 (USE FORMAT 7 FOR FULLTEXT)
U.S. Re Market Shaken But Not Stirred Standard & Poor's Says
National Underwriter Property & Casualty-Risk & Benefits Management, pS6
July 17, 1995
Language: English Record Type: Fulltext
Document Type: Magazine/Journal; Trade
Word Count: 4017

... U.S. reinsurance market illustrates the tiered structure of capital strength among competing firms. As **ranked** by policyholders' surplus, the top-tier of reinsurers (number one to number six) continues to...

collateralized mortgage obligations, mainly consisting of agency pass-throughs in more senior tranches.
The collective **investment portfolio** of active reinsurers is comprised of 62 percent bonds, 26 percent common stock, 3 percent...

...the issue of credit quality, over 99 percent of the reinsurance industry's fixed-income **portfolio** was rated **investment** grade as categorized by the National Association of Insurance Commissioners. Reinsurers' assumption of substantial risks...
...the trends in non catastrophe insurance rates exhibit little change.
Among active reinsurers, the underwriting **cash flow ratio** - which is roughly earned premium inflow divided by loss and expense outflow rose to 118 percent for 1994 versus 114 percent in the prior year. Although sources of underwriting **cash flow** still exceed uses, this **ratio** is far below the 140 percent range of the late 1980s.
Resurgent premium growth has...

...years, thus allowing for cash flow growth since 1992's 101 percent figure. The total **cash flow ratio** , which includes the effects of investment and finance decisions, stood at 136 percent for 1994...
19950717

9/3,K/9 (Item 2 from file: 16)
DIALOG(R)File 16:Gale Group PROMT(R)

03418501 Supplier Number: 44755818 (USE FORMAT 7 FOR FULLTEXT)
Catastrophes Bedevil U.S. Reinsurers
National Underwriter Property & Casualty-Risk & Benefits Management, pB6
June 13, 1994
Language: English Record Type: Fulltext
Document Type: Magazine/Journal; Trade
Word Count: 2630

... highlights the difference in financial strength between the various tiers of the reinsurance market.
As **ranked** by policyholder surplus, top-tier (**ranked** 1-10) reinsurers continue to report stronger financial results, market-share increases, greater capital strength and more adequate loss reserves compared with their second (**ranked** 11-20), third (**ranked** 21-35) and bottom-tier (**ranked** 36-64) competitors.
For the purposes of this analysis, S&P has focused on 64...

...Indemnity.)
The credit quality of the bond portfolio is excellent, with 99 percent of the **portfolio** rated **investment** grade as categorized by the National Association of Insurance Commissioners
S&P expects no change...Rebounds:
Hardening property-catastrophe rates and declining catastrophe losses resulted in improved underwriting and total **cash - flow** ratios in 1993.
The underwriting **cash - flow ratio** for the active reinsurance industry was 114.1 percent in 1993, a 13.2 percentage point improvement over 1992. The total **cash - flow ratio** , which includes investment income, also improved significantly to 131.6 percent from 118.0 percent...

...constrain cash flow in the 1990s.
In 1993, top-tier reinsurers recorded a healthy underwriting **cash - flow ratio** of 124.4 percent - well above the remaining tiers, none of which recorded a ration...POOR'S UNIVERSE OF 64 ACTIVE U.S. REINSURERS

Surplus Rank	Company	Statutory Surplus 1993 (000 omitted)	Net Premiums Written 1993 (000 omitted)
	TIER 1		
1	National Indemnity Co.	7,514...	

19940613

9/3,K/10 (Item 3 from file: 16)

DIALOG(R)File 16:Gale Group PROMT(R)

02924507 Supplier Number: 43951013 (USE FORMAT 7 FOR FULLTEXT)
Exhibit B: U.S. Professional Reinsurance Companies Balance Sheet (Part 2)
National Underwriter Property & Casualty-Risk & Benefits Management, pS7
July 5, 1993
Language: English Record Type: Fulltext
Document Type: Magazine/Journal; Trade
Word Count: 2344

(USE FORMAT 7 FOR FULLTEXT)
TEXT:
...the National Association of Insurance Commissioners. Common equity holdings made up 13 percent of the **investment portfolio** at $5.9 billion, with cash and short-term investments making up the bulk of...
... and record catastrophe loss payments, coupled with intense competition for market share, have ground underwriting **cash flow** to a halt.

The underwriting **cash flow ratio** has trended downward over the last three years to an eight year low of 100...

...year ended Dec. 31, 1992.

This ratio is significantly lower than in 1986, when the **cash flow ratio** for active U.S. professional reinsurers reached 146 percent. On a total cash flow basis...

...of active U.S. reinsurers recorded negative operating income in 1992.

Notably, bottom tier companies (**ranked** 36 to 71) reported a return on revenue significantly above the second and third tier...

...surplus was 2.14-times for the top 10 reinsurers, 1.99-times for those **ranked** 11 through 20 (second tier companies), 1.88-times for those **ranked** 21 through 35 (third tier companies), and only .86-times for the remaining 36 industry...Reinsurance Companies

Balance Sheet Items and Ratios (Part 2)

Rank	Rating	Company Name	Net Premiums Written 1991 Surplus	Net Investment Income 1992
1	AAA	General Reinsurance Corp	1,805,982	582...

19930705

9/3,K/11 (Item 1 from file: 148)

DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2004 The Gale Group. All rts. reserv.

09919026 SUPPLIER NUMBER: 19998393 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Investor expectations and the performance of value stocks versus growth stocks.
Bauman, W. Scott; Miller, Robert E.
Journal of Portfolio Management, v23, n3, p57(12)
Spring, 1997
ISSN: 0095-4918 LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 5673 LINE COUNT: 00451

... Rozeff (1984), and Dowen and Bauman (1986) have found that the effects of portfolio return **rankings** are essentially the same, whether stocks with deficit EPS are included in or excluded from...free rate is subtracted as a constant from the returns of all portfolios, the performance **rankings** of portfolios are unaffected by the modified ratio. Many if not a majority of fundamental...which means that the average analyst forecast appears to have an optimistic bias.

Price-to- **Cash Flow Ratio** Criterion and Earnings Surprises

It is sometimes argued that the **ratio** of price-to- **cash flow** per share is a better measure of value than the PER because the annual depreciation...is supported by a favorable EPS growth rate forecast. Similarly, it is easier for an **investment** advisor or **portfolio** manager to justify the purchase of such a stock. If the EPS are subsequently disappointing...

19970322

9/3,K/12 (Item 2 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2004 The Gale Group. All rts. reserv.

08425557 SUPPLIER NUMBER: 17869649 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Exchange risk sensitivity and its determinants: a firm and industry analysis of U.S. multinationals.
Choi, Jongmoo Jay; Prasad, Anita Mehra
Financial Management, v24, n3, p77(12)
Autumn, 1995
ISSN: 0046-3892 LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 6305 LINE COUNT: 00538

... provides a better understanding of the distribution of these coefficient values. The 61 coefficients are **ranked** in descending order and grouped into quartiles. The first quartile, which includes the firms with...For example, a firm with $200 million in total sales and a 20% foreign sales **ratio** will have a larger **cash flow** exposed to exchange rate risk than a firm with $100 million in total sales and...that exchange exposure patterns may be examined by using other classification schemes, such as capitalization- **ranked** portfolios or the export- or import-orientation of firms. However, given our focus on examining...
Multinational Transactions," Financial Management (Autumn), 23-29.

Elton, E.J. and M. Gruber, 1991, Modern **Portfolio** Theory and **Investment** Analysis, 4th ed., New York, NY, John Wiley.

Errunza, V.R. and L.W. Senbet...

19950900

9/3,K/13 (Item 3 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2004 The Gale Group. All rts. reserv.

07310166 SUPPLIER NUMBER: 15469348 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Catastrophes bedevil U.S. reinsurers. (U.S. Reinsurance Report)
Walsh, Thomas C.; Gangemi, Mary Anne
National Underwriter Property & Casualty-Risk & Benefits Management, n24, pS6(6)
June 13, 1994
ISSN: 1042-6841 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT; ABSTRACT
WORD COUNT: 2169 LINE COUNT: 00184

... highlights the difference in financial strength between the various tiers of the reinsurance market.
As **ranked** by policyholder surplus, top-tier (**ranked** 1-10) reinsurers continue to report stronger financial results, market-share increases, greater capital strength and more adequate loss reserves compared with their second (**ranked** 11-20), third (**ranked** 21-35) and bottom-tier (**ranked** 36-64) competitors.
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...Rebounds:
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The underwriting **cash - flow ratio** for ...114.1 percent in 1993, a 13.2 percentage point improvement over 1992. The total **cash - flow ratio** , which includes investment income, also improved significantly to 131.6 percent from 118.0 percent...

...constrain cash flow in the 1990s.
In 1993, top-tier reinsurers recorded a healthy underwriting **cash - flow ratio** of 124.4 percent--well above the remaining tiers, none of which recorded a ratio...

19940613

9/3,K/14 (Item 4 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2004 The Gale Group. All rts. reserv.

05579685 SUPPLIER NUMBER: 11815084 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Prediction of acquisition candidates: methodological comparisons.
Clayton, Ronnie J.; Fields, M. Andrew
Mid-Atlantic Journal of Business, v27, n3, p233(18)
Dec, 1991
ISSN: 0732-9334 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT
WORD COUNT: 5582 LINE COUNT: 00484

... of the logistic CDF. The variables included are net working capital, the industry adjusted debt **ratio** , **cash flow** as a percent of total assets, average dividends, and market price to cash flow per... discriminant model is shown in Table 4-C. When the first 171 firms from the

ranking of discriminant scores are placed in the acquired group, 24 of these firms are actually...reflect accurately the actual group sizes. As Palepu (1986) notes, this still preserves the relative **ranking** of the observations. (2)The selection of variables was based upon previous work done in...

...firms in each of the respective groups, i.e., the first 171 firms from the **ranking** provided by model scores are placed in the acquired group. (6)Additional information on this...A. (1991), "Portfolio Selection and An Optimal Cutoff Probability in Predicting Takeover Targets," Advances in **Investment** Analysis and **Portfolio** Management, 1, 279-293. Harris, R. S., J. F. Stewart, and W. T. Carleton (1982...

19911200

9/3,K/15 (Item 5 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2004 The Gale Group. All rts. reserv.

03118656 SUPPLIER NUMBER: 04716239 (USE FORMAT 7 OR 9 FOR FULL TEXT)
It was a boffo year for the business, but where are the customers' yachts? (Fund Watch)
Vreeland, Leslie N.
Money, v16, p28(4)
Feb, 1987
DOCUMENT TYPE: column ISSN: 0149-4953 LANGUAGE: ENGLISH
RECORD TYPE: FULLTEXT
WORD COUNT: 2112 LINE COUNT: 00161

19870200

9/3,K/16 (Item 6 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2004 The Gale Group. All rts. reserv.

02482284 SUPPLIER NUMBER: 03996359 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Favorite themes, rich variations.(interview with portfolio manager Harvey Eisen)
Taub, Stephen
Financial World, v154, p30(5)
Oct 30, 1985
CODEN: FIWOA ISSN: 0015-2064 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT
WORD COUNT: 2980 LINE COUNT: 00219

TEXT:
...accounts and mutual funds. Through the first nine months of 1985, the 43-year-old **investment** adviser's **portfolio** **ranked** first among those tracked by CDA Investment Technologies of Silver Spring, Md., with a 36...
... decide which stocks to buy?
A We look at a number of screens. But the **ratio** of price to **cash flow** is probably the most important one because cash flow is the amount of money that...

19851030

9/3,K/17 (Item 1 from file: 810)
DIALOG(R)File 810:Business Wire
(c) 1999 Business Wire . All rts. reserv.

0824700 BW0005

S & P: S&P Assigns Public Info Rtgs to 5 Japan Rail Operators

March 23, 1998

Byline: Business Editors

...investment needs for the next several years.
Excluding the former Japan National Railway companies, Hankyu **ranks** fourth among its peers in terms of traffic volume. The company's service territory covers...store of large, low-cost landholdings as well as the strength of its well-located **investment** property **portfolio** . Somewhat offsetting these positive factors is weakness in the company's hotel business, which is not likely to achieve profitability in the near future.
Kintetsu's financial profile is weak, **ranking** slightly below the industry average. The rail operator has the lowest profitability among the industry...

...high debt usage and weak retail operations.
Excluding the former Japan National Railway companies, Odakyu **ranks** third among its peers in terms of traffic volume as gauged by total passenger kilometers...

...railway demand and its highly profitable property business.
Excluding former Japan National Railway companies, Tobu **ranks** second among its peers in terms of traffic volume, with 13.9 billion passenger kilometers...cash flow levels to remain even or turn downwards. This will weaken the company's **cash flow** protection; the **ratio** of funds from operations to net debt is likely to drop below 7%. Significant near...

...and weakness in peripheral leisure and hospitality operations.
Excluding former Japan National Railway companies, Tokyu **ranks** sixth among its peers in terms of passenger volume. Headquartered in the central Tokyo district...

...between 2 times (x) to 3x. Stable profits and sizable depreciation also result in steady **cash flow** . The **ratio** of funds from operations to debt ranges from 5% to 7%, about average for major...
? ds

Set	Items	Description
S1	149434	INVESTMENT (2N) PORTFOLIO
S2	41	CASH (4N) FLOW (4N) RATION
S3	3	S2 AND CALCULAT?
S4	3	RD S3 (unique items)
S5	8897	CASH (3N) FLOW (3N) RATIO
S6	179	S1 AND S5
S7	57	S6 AND PY<1999

```
S8          48   RD S7 (unique items)
S9          17   S8 AND RANK?
? s s9 and "cash flow ratio"
               17  S9
                0  CASH FLOW RATIO
     S10        0  S9 AND "CASH FLOW RATIO"
? s s9 and cash(4w)flow(4w)ratio
               17  S9
          4892912  CASH
          3109821  FLOW
          1740021  RATIO
             4363  CASH(4W)FLOW(4W)RATIO
     S11       12  S9 AND CASH(4W)FLOW(4W)RATIO
? t s11/3,k/all
```

11/3,K/1 (Item 1 from file: 15)

DIALOG(R)File 15:ABI/Inform(R)

01253922 99-03318
U.S. Re: Finding firm ground in A soft market
Elkind, Craig K; Levin, Alan M
National Underwriter (Property & Casualty/Risk & Benefits Management)
v100n29 PP: S6-S13 Jul 15, 1996
ISSN: 1042-6841 JRNL CODE: NUN
WORD COUNT: 5787

...TEXT: been quite useful for many participants in the marketplace to identify companies and their relative **ranking** within the industry. We hope that this improved **ranking** , based on the security rating Standard & Poor's provides for each of these reinsurers, will... instruments to ascertain inherent prepayment/extension risk in large interest rate swing scenarios.

The collective **investment portfolio** of active reinsurers is comprised of 57.9 percent bonds, 29.4 percent common stock...

... In terms of credit quality, over 99 percent of the reinsurance industry's fixed income **portfolio** was rated **investment** grade by Standard & Poor's.
The traditional ... 126.5 percent for 1995 versus 117.9 percent in the prior year. The total **cash flow ratio** , which includes the effects of investing and financing decisions, stood at 143.3 percent for...

...DESCRIPTORS: Ratings & **rankings**

11/3,K/2 (Item 2 from file: 15)

DIALOG(R)File 15:ABI/Inform(R)

01063859 97-13253
U.S. re market shaken but not stirred, Standard & Poor's says
Elkind, Craig; Walsh, Thomas
National Underwriter (Property & Casualty/Risk & Benefits Management)
v99n29 PP: S6-S12 Jul 17, 1995
ISSN: 1042-6841 JRNL CODE: NUN
WORD COUNT: 3945

...TEXT: U.S. reinsurance market illustrates the tiered structure of

capital strength among competing firms. As **ranked** by policyholders' surplus, the top-tier of reinsurers (number one to number six) continues to ... collateralized mortgage obligations, mainly consisting of agency pass-throughs in more senior tranches.

The collective **investment portfolio** of active reinsurers is comprised of 62 percent bonds, 26 percent common stock, 3 percent...

... the issue of credit quality, over 99 percent of the reinsurance industry's fixed-income **portfolio** was rated **investment** grade as categorized by the National Association of Insurance Commissioners. Reinsurers' assumption of substantial risks...
...the trends in non catastrophe insurance rates exhibit little change.

Among active reinsurers, the underwriting **cash flow ratio** --which is roughly earned premium inflow divided by loss and expense outflow--rose to 118 percent for 1994 versus 114 percent in the prior year. Although sources of underwriting **cash flow** still exceed uses, this **ratio** is far below the 140 percent range of the late 1980s.

Resurgent premium growth has...

... years, thus allowing for cash flow growth since 1992's 101 percent figure. The total **cash flow ratio** , which includes the effects of investment and finance decisions, stood at 1 36 percent for...

...DESCRIPTORS: Ratings & **rankings** ;

11/3,K/3 (Item 3 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)

00873374 95-22766
Catastrophes bedevil US reinsurers
Walsh, Thomas C; Gangemi, Mary Anne
National Underwriter (Property/Casualty/Employee Benefits) v98n24 PP: SS6-SS7+ Jun 13, 1994
ISSN: 0898-8897 JRNL CODE: NUN
WORD COUNT: 1975

...TEXT: highlights the difference in financial strength between the various tiers of the reinsurance market.

As **ranked** by policyholder surplus, top-tier (**ranked** 1-10) reinsurers continue to report stronger financial results, market-share increases, greater capital strength and more adequate loss reserves compared with their second (**ranked** 11-20), third (**ranked** 21-35) and bottom-tier (**ranked** 36-64) competitors.

For the purposes of this analysis, S&P has focused on 64...

...Indemnity.)
The credit quality of the bond portfolio is excellent, with 99 percent of the **portfolio** rated **investment** grade as categorized by he National Association of Insurance Commissioners

S&P expects no change...REBOUNDS:

Hardening property-catastrophe rates and declining catastrophe losses

resulted in improved underwriting and total **cash - flow** ratios in 1993.

The underwriting **cash - flow ratio** for the active reinsurance industry was 114.1 percent in 1993, a 13.2 percentage...

...constrain cash flow in the 1990s.

In 1993, top-tier reinsurers recorded a healthy underwriting **cash - flow ratio** of 124.4 percent--well above the remaining tiers, none of which recorded a ratio...

...DESCRIPTORS: Ratings & **rankings** ;

11/3,K/4 (Item 4 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)

00734474 93-83695
Record catastrophe losses stagger reinsurers
Walsh, Thomas C; Gangemi, Mary Anne
National Underwriter (Property/Casualty/Employee Benefits) v97n27 PP: SS3-SS10 Jul 5, 1993
ISSN: 0898-8897 JRNL CODE: NUN
WORD COUNT: 3625

...TEXT: when the industry's combined ratio reached a high of 130.9 percent. Indeed, 1992 **ranks** as the third-worst underwriting year on record for the reinsurance industry as a whole...

... catastrophe segment of the reinsurance industry has opened windows of opportunity for first (top 10 **ranked** by net premiums written), second (**ranked** 11-20) and third (**ranked** 21-35) tier players, who seek to benefit from more favorable property catastrophe rates.

Well... impacted the underwriting results of the U.S. reinsurance industry. Driven by Hurricane Andrew, 1992 **ranks** as the third worst underwriting year for professional reinsurers in the last 32 years.
While...

...and third tier reinsurers, recording a combined ratio of 114 percent, as compared to reinsurers **ranked** 11 through 20 (122.6 percent) and 21 through 35 (125.2 percent).

The differentiation...

... percent for the top 10 active companies, compared to 91.2 percent for those companies **ranked** 11 through 20, and 96 percent for those **ranked** 21 through 35.

Although reinsurers falling within these categories differ in terms of risk profile...

... not exposed to the asset-quality issues which have plagued the life insurance industry. The **investment portfolio** of the 71 active professional reinsurers remains conservative. The industry invests primarily in fixed income...

... the National Association of Insurance Commissioners. Common equity holdings made up 13 percent of the **investment portfolio** at $5.9

billion, with cash and short-term investments making up the bulk of...and record catastrophe loss payments, coupled with intense competition for market share, have ground underwriting **cash flow** to a halt.

The underwriting **cash flow ratio** has trended downward over the last three years to an eight year low of 100...

...year ended Dec. 31, 1992.

This ratio is significantly lower than in 1986, when the **cash flow ratio** for active U.S. professional reinsurers reached 146 percent. On a total cash flow basis...

...of active U.S. reinsurers recorded negative operating income in 1992.

Notably, bottom tier companies (**ranked** 36 to 71) reported a return on revenue significantly above the second and third tier...

...surplus was 2.14-times for the top 10 reinsurers, 1.99-times for those **ranked** 11 through 20 (second tier companies), 1.88-times for those **ranked** 21 through 35 (third tier companies), and only .86-times for the remaining 36 industry...

...DESCRIPTORS: Ratings & **rankings** ;

11/3,K/5 (Item 1 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)

01207888 SUPPLIER NUMBER: 06167870 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Lotus-compatible software products. (Listings)
Koerner, Katherine
Lotus, v3, n12, p143(19)
Dec, 1987
ISSN: 8756-7334 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT
WORD COUNT: 21738 LINE COUNT: 01817

... add others. Performs analysis by detailed system elements, lists characteristics in order of priority, and **ranks** each system. Includes companion guide. Worksheet application for 1-2-3 Releases 1A or 2...Center, Rolling Meadows, IL 60008, 800-323-8552. Analysis module performs percent-and-dollar-change, **cash - flow** , **ratio** , and pro forma analyses. Database module maintains data used in Analysis module and allows the...of the budget to multiple accounts. Determines the impact of variables on defined objectives and **ranks** variables by impact level. Performs simultaneous Monte Carlo simulation with as many as 20 variables... significant factors influencing a decision. Decisions are based on weights allocated to criteria and the **rankings** assigned to each decision item or option. Worksheet application for 1-2-3 Releases 1A...CA 90278, 213-379-1205. Provides three integrated decision-support models: Evaluate helps quantify and **rank** decision options, providing reasons for rejected options; Select helps select the optimal set of activities...

...7300. Linear programming capabilities automatically produce optimal solutions for staff scheduling; product mix; resource planning; **investment - portfolio** selection; management of assets, liabilities, projects, and inventory; and

19871200

11/3,K/6 (Item 1 from file: 16)
DIALOG(R)File 16:Gale Group PROMT(R)

03926134 Supplier Number: 45672805 (USE FORMAT 7 FOR FULLTEXT)
U.S. Re Market Shaken But Not Stirred Standard & Poor's Says
National Underwriter Property & Casualty-Risk & Benefits Management, pS6
July 17, 1995
Language: English Record Type: Fulltext
Document Type: Magazine/Journal; Trade
Word Count: 4017

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19950717

11/3,K/7 (Item 2 from file: 16)
DIALOG(R)File 16:Gale Group PROMT(R)

03418501 Supplier Number: 44755818 (USE FORMAT 7 FOR FULLTEXT)
Catastrophes Bedevil U.S. Reinsurers
National Underwriter Property & Casualty-Risk & Benefits Management, pB6
June 13, 1994
Language: English Record Type: Fulltext
Document Type: Magazine/Journal; Trade
Word Count: 2630

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Surplus **Rank**	Company	Statutory Surplus 1993 (000 omitted)	Net Premiums Written 1993 (000 omitted)
	TIER 1		
1	National Indemnity Co.	7,514...	

19940613

11/3,K/8 (Item 3 from file: 16)

02924507 Supplier Number: 43951013 (USE FORMAT 7 FOR FULLTEXT)
Exhibit B: U.S. Professional Reinsurance Companies Balance Sheet (Part 2)
National Underwriter Property & Casualty-Risk & Benefits Management, pS7
July 5, 1993
Language: English Record Type: Fulltext
Document Type: Magazine/Journal; Trade
Word Count: 2344

(USE FORMAT 7 FOR FULLTEXT)
TEXT:
...the National Association of Insurance Commissioners. Common equity holdings made up 13 percent of the **investment** **portfolio** at $5.9 billion, with cash and short-term investments making up the bulk of...
... and record catastrophe loss payments, coupled with intense competition for market share, have ground underwriting **cash** **flow** to a halt.
The underwriting **cash** **flow** **ratio** has trended downward over the last three years to an eight year low of 100...

...year ended Dec. 31, 1992.
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...of active U.S. reinsurers recorded negative operating income in 1992.
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Rank	Rating	Company Name	Net Premiums Written 1991 Surplus	Net Investment Income 1992
1	AAA	General Reinsurance Corp	1,805,982	582...

19930705

11/3,K/9 (Item 1 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2004 The Gale Group. All rts. reserv.

09919026 SUPPLIER NUMBER: 19998393 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Investor expectations and the performance of value stocks versus growth stocks.
Bauman, W. Scott; Miller, Robert E.
Journal of Portfolio Management, v23, n3, p57(12)
Spring, 1997
ISSN: 0095-4918 LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 5673 LINE COUNT: 00451

... Rozeff (1984), and Dowen and Bauman (1986) have found that the effects of portfolio return **rankings** are essentially the same, whether stocks with deficit EPS are included in or excluded from...free rate is subtracted as a constant from the returns of all portfolios, the performance **rankings** of portfolios are unaffected by the modified ratio. Many if not a majority of fundamental...which means that the average analyst forecast appears to have an optimistic bias.

Price-to- **Cash Flow Ratio** Criterion and Earnings Surprises

It is sometimes argued that the **ratio** of price-to- **cash flow** per share is a better measure of value than the PER because the annual depreciation...is supported by a favorable EPS growth rate forecast. Similarly, it is easier for an **investment** advisor or **portfolio** manager to justify the purchase of such a stock. If the EPS are subsequently disappointing...

19970322

11/3,K/10 (Item 2 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB
(c)2004 The Gale Group. All rts. reserv.

07310166 SUPPLIER NUMBER: 15469348 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Catastrophes bedevil U.S. reinsurers. (U.S. Reinsurance Report)
Walsh, Thomas C.; Gangemi, Mary Anne
National Underwriter Property & Casualty-Risk & Benefits Management, n24, pS6(6)
June 13, 1994
ISSN: 1042-6841 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT; ABSTRACT
WORD COUNT: 2169 LINE COUNT: 00184

... highlights the difference in financial strength between the various tiers of the reinsurance market.

As **ranked** by policyholder surplus, top-tier (**ranked** 1-10) reinsurers continue to report stronger financial results, market-share increases, greater capital strength and more adequate loss reserves compared with their second (**ranked** 11-20), third (**ranked** 21-35) and bottom-tier (**ranked** 36-64) competitors.

For the purposes of this analysis, S&P has focused on 64...

...Indemnity.)

The credit quality of the bond portfolio is excellent, with 99 percent of the **portfolio** rated **investment** grade as categorized by the National Association of Insurance Commissioners

S&P expects no change...

...Rebounds:

Hardening property-catastrophe rates and declining catastrophe losses resulted in improved underwriting and total **cash - flow** ratios in 1993.

The underwriting **cash - flow ratio** for ...114.1 percent in 1993, a 13.2 percentage point improvement over 1992. The total **cash - flow ratio** , which includes investment income, also improved significantly to 131.6 percent from 118.0 percent...

...constrain cash flow in the 1990s.

In 1993, top-tier reinsurers recorded a healthy underwriting **cash - flow ratio** of 124.4 percent--well above the remaining tiers, none of which recorded a ratio...

19940613

11/3,K/11 (Item 3 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB

03118656 SUPPLIER NUMBER: 04716239 (USE FORMAT 7 OR 9 FOR FULL TEXT)
It was a boffo year for the business, but where are the customers' yachts? (Fund Watch)
Vreeland, Leslie N.
Money, v16, p28(4)
Feb, 1987
DOCUMENT TYPE: column ISSN: 0149-4953 LANGUAGE: ENGLISH
RECORD TYPE: FULLTEXT
WORD COUNT: 2112 LINE COUNT: 00161

19870200

11/3,K/12 (Item 1 from file: 810)
DIALOG(R)File 810:Business Wire

0824700 BW0005

S & P: S&P Assigns Public Info Rtgs to 5 Japan Rail Operators

March 23, 1998

Byline: Business Editors

...investment needs for the next several years.
Excluding the former Japan National Railway companies, Hankyu **ranks** fourth among its peers in terms of traffic volume. The company's service territory covers...store of large, low-cost landholdings as well as the strength of its well-located **investment** property **portfolio** . Somewhat offsetting these positive factors is weakness in the company's hotel business, which is not likely to achieve profitability in the near future.
Kintetsu's financial profile is weak, **ranking** slightly below the industry average. The rail operator has the lowest profitability among the industry...

...high debt usage and weak retail operations.
Excluding the former Japan National Railway companies, Odakyu **ranks** third among its peers in terms of traffic volume as gauged by total passenger kilometers...

...railway demand and its highly profitable property business.
Excluding former Japan National Railway companies, Tobu **ranks** second among its peers in terms of traffic volume, with 13.9 billion passenger kilometers...cash flow levels to remain even or turn downwards. This will weaken the company's **cash flow** protection; the **ratio** of funds from operations to net debt is likely to drop below 7%. Significant near...

...and weakness in peripheral leisure and hospitality operations.
Excluding former Japan National Railway companies, Tokyu **ranks** sixth among its peers in terms of passenger volume. Headquartered in the central Tokyo district...

...between 2 times (x) to 3x. Stable profits and sizable depreciation also result in steady **cash flow** . The **ratio** of funds from operations to debt ranges from 5% to 7%, about average for major...

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? ds

Set     Items   Description
S1     149434   INVESTMENT (2N) PORTFOLIO
S2         41   CASH (4N) FLOW (4N) RATION
S3          3   S2 AND CALCULAT?
S4          3   RD S3 (unique items)
S5       8897   CASH (3N) FLOW (3N) RATIO
S6        179   S1 AND S5
S7         57   S6 AND PY<1999
S8         48   RD S7 (unique items)
S9         17   S8 AND RANK?
S10         0   S9 AND "CASH FLOW RATIO"
S11        12   S9 AND CASH(4W)FLOW(4W)RATIO
?
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